DOCUMENT RESUME

ED 187 868 CE 025 105

TITLE	Project EFFECT. Energy for the Future: Education, Conservation, Training. Curriculum Guide for the Training of Energy Extension Agents. A Working Paper, Volume ii: Supplemental Materials.
INSTITUTION	Indiana Univ., South Bend. Center for Energy Conservation.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.
PUB DATE	79
NOTE	237p.: For related documents see CE 025 099-103.
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Conservation Education: *Energy Conservation; *Extension Agents: Instructional Materials; Learning Activities: Resource Materials: Tests: Vocational Education
IDENTIFIERS	Energy Extension Agents

ABSTRACT

Intended to be used in conjunction with the Project EFFECT (Energy for the Future--Education, Conservation, Training) Curriculum Guide for Training Energy Extension Agents (available in ERIC as CE 025 100-103), this volume contains supplementary materials and full references to all outside resources used in teaching the modules. Samples of worksheets, handouts, and examination (with answers) are arranged in sections by module. An introductory page to each section indicates the number of the objective in the module to which material corresponds. To facilitate the locating of specific references, a bibliography-index is arranged alphabetically by modules. Materials are divided within each module into resources and evaluation materials and then arranged alphabetically under these two headings. Page numbers key rescurces to Volume ii. (YLB)

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PROJECT EFFECT

Energy For the Future: Education, Conservation, Training

CURRICULUM GUIDE

for the training of

ENERGY EXTENSION AGENTS

A WORKING PAPER

Volume ii

March, 1979

Project Staff: James H. Ryan, Ph.D., Project Director
Neil V. Weber, Ph.D., Academic Coordinator
Gail S. Dowty, Project Administrator
Robert F. Werner, Jr., Technical Coordinator
James D. Regelean, Curriculum Development Associate
Paul C. Boyer, Audit Materials Specialist
Patricia A. Falsetti, Administrative Secretary

Indiana University at South Bend: Division of Arts and Sciences
Division of Continuing Education
Division of General and Technical Studies

Funded by the Department of Health, Education, Welfare, U.S. Office of Education,
Community Service and Continuing Education Branch,
Grant #G77-2645 under Title I, Special Projects

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CE 025 105

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PROJECT EFFECT

CURRICULUM GUIDE -- VOLUME ii

SUPPLEMENTARY MATERIALS

INTRODUCTION

This volume, intended to be used in conjunction with the Curriculum Guide, Volume i, contains samples of worksheets, handouts and examinations for each module, as well as full references to all outside resources used in teaching the modules. Arranged in the same order as Volume i and similarly color-coded, each sample of teaching material and each resource citation is cross-referenced to the appropriate module in Volume i. Those items highlighted by two asterisks** in Volume i may be found in Volume ii within the same module.

To facilitate the locating of specific references, the Bibliography-Index has been arranged alphabetically by modules, and within modules. Within the bibliography, page numbers in both Volumes i and ii are indicated.

Special commendation must be accorded James Regelean, Curriculum Development Associate, and Paul Boyer, Audit Materials Specialist for taking special responsibility in assembling and organizing this material.

Gail S. Dowty
Project Administrator

ORIENTATION

The following materials are used to meet the Orientation objective in Volume 1 (page 13).

Objective	Resource
1	Calendar of month one activities, plus Resource A-D.
2	Project staff.
3	Group Dynamics Consultant.
4	CETA regulations.
5	IUSB fact sheet brochure; maps of library and campus; IUSB calendar of events; bus schedule.
Evaluation	Critique and evaluation forms filled out by students at the end of orientation week.

ORIENTATION WEEK

Welcome to Project EFFECT! After months of anticipation and planning it is a great pleasure to greet you - - our first class of trainees. This first week - orientation - will be busy and full. In this brief introduction, we want to let you know what we hope to accomplish by the end of the week and what kinds of activities have been scheduled. Your questions are encouraged and welcome at any point.

The orientation is meant to accomplish several things:

. . . . . to increase your understanding of Project EFFECT and what we hope to accomplish
. . . . . to familiarize you with the campus of Indiana University at South Bend
. . . . . to help you to understand Policies and Procedures relating to such things as pay and attendance
. . . . . to help you get to know the Project Staff and Project Team
. . . . . to help you get to know each other
. . . . . to answer your questions

Throughout this week we have scheduled activities designed to meet these goals. Important components of the week are: campus tours, a review of learning materials, introductions to people you will be working with, and plenty of time to ask questions and familiarize yourself with the place and the people.

As the week progresses, we will keep you informed of the daily agenda and we ask that you keep us informed of your needs and questions.

We are all part of a very new, very exciting project. This is an opportunity for all of us to create a new professional role which will meet a real need in our society. Your participation, your questions, your reactions will define that role and, as the first Energy Extension Agents, you will be the models for future groups of trainees both here and elsewhere.

Gail S. Dowty
Project Administrator

Robert F. Werner, Jr.
Technical Coordinator

RESOURCE A

ORIENTATION

OBJECTIVES: Orientation activities are designed to help participants

1) Understand the objectives of Project EFFECT - both in its broad goals and as it directly affects the trainees in terms of curriculum and training.

2) Become acquainted with Project staff and key university personnel and know what can be expected of each of them.

3) Begin to know each other as individuals and make a start toward forming a group.

4) Understand Project Policies and Procedures i.e., pay procedures and attendance requirements.

5) Become familiar with Indiana University at South Bend and understand what services and facilities are available and become a part of the I.U.S.B. community.

RESOURCE B

ORIENTATION PACKET

A folder or plastic binder will include the following:

1) Welcome
2) Description of Project EFFECT
3) Program of study listing learning modules.
4) Policies and Procedures - not just rules, but an explanation of what we expect from them and what they can expect from us.
5) Biographical sketches of staff.
6) Student-Staff Directory.
7) Maps, bus routes, I.U.S.B. informational flyers.
8) Program of the orientation.

RESOURCE C

PROJECT EFFECT: ENERGY FOR THE FUTURE: EDUCATION, CONSERVATION, AND TRAINING

A program jointly developed and conducted by the IUSB Divisions of Continuing Education, Arts and Sciences, and General and Technical Studies in cooperation with regional CETA agencies in South Bend, St. Joseph and Elkhart counties and sponsored by the Department of Health, Education, and Welfare, Offices of Education, Washington, D.C., Special Community Service and Continuing Education projects.

The most critical problem facing mankind in the near future is making the best use of our precious energy resources. The problem is first to change the attitudes of people about energy use. Particularly in the United States, the idea of unlimited, inexpensive energy for all must give way to conservative, thoughtful use of limited energy resources. Once people become aware of the need for immediate action to prevent drastic hardship in the future, the problem becomes how to get reliable and unbiased information upon which to act. Finally, requirements for effective energy use are constantly changing as resources dwindle and technology advances.

Project EFFECT is designed to meet this complex problem by developing and field-testing a new model of adult education and establishing a new occupation -- the "Energy Extension Agent". The entire project has three primary objectives:

1. Curriculum Development: To develop a comprehensive training program for adults with average skills and background, applicable to local community energy education needs and transportable to other communities and regions.

2. Energy Extension Agent: To create the role of and provide training for a new community resource, the Energy Extension Agent:
   a. Utilizing CETA clients in a program of career training and development;
   b. Providing definable technical skills for use in energy-related activities;
   c. Producing a group of paraprofessional energy consultants to augment community resources;
   d. Establishing a model of occupational competence for transfer to other communities.

3. Impact on Community Attitudes and Behavior: To cause a measurable change in the community's collective consciousness regarding energy utilization:
   a. Providing valid and unbiased criteria for evaluating energy use and conservation in light building and residential settings;
   b. Matching energy conservation skills and information to neighborhoods and community requirements;
   c. Identifying and using existing community resources for education and consultation.

To meet these objectives, the project intends to pursue the following major activities:

1. Production of a package of training materials on energy utilization, tested both with CETA trainees and community participants;

RESOURCE D

2. Selection, training and certification of a team of 24 Energy Extension Agents;
3. Placing the Energy Extension Agents in local agencies and organizations as energy utilization resources and consultants;
4. Application of energy conservation techniques in the community through residential audits and community, neighborhood and agency workshops;
5. Establishment of a community resource file of people and agencies;
6. Promotion of community education about energy utilization through local, regional and national media emphasis;
7. Delivery of materials and workshops outside of the immediate project region.

RESOURCE D

ALGEBRA REVIEW

The following materials are used to meet the Algebra Review module objectives in Volume i (p. 16).

Objective	Resource
1-4	Class exercises lecture materials and handouts Resource A and B.
5-8	Sample calculations using Energy Use Survey materials - Project Retrotech
Evaluation	Quizzes Resource C-G.

PROJECT EFFECT

Algebra Review

1. **WATCHING THE SIGNS:**

   a. In adding numbers (variables) with alternate signs (+, -) subtract the smaller number from the larger one and precede your answer by the sign of the larger number, e.g.

   $+3 - 8 = -5$ $\qquad$ $2x - 10x = 8x$

   b. When two numbers have the same sign,

   (i) their sum is preceded by the same sign, e.g.

   $5 + 5 = +10$; $\quad -5 - 5 = -10$; $\quad 4x + 6x = 10x$; $\quad -4x - 6x = -10x$

   (ii) their product is preceded by a positive sign (+) e.g.;

   $5 \times 5 = 25$; $\quad -5 \times -5 = +25$; $\quad 4x \times 6x = 24x^2$ etc.

   (iii) their quotient is preceded by a positive sign (+) e.g.;

   $25/5 = 5$; $\quad \frac{-25}{-5} = +5$; $\quad \frac{-4x}{-6x} = +2/3$ etc.

   c. When two numbers have alternate signs (+, -);

   (i) their product is negative (-)

   (ii) their quotient is negative (-)

2. **Summary**

   (+) + (+) = +

   (+) + (-) = + or -

   (-) + (-) = -

   (-) - (-) = + or -

   (+) x (+) = +

   (+) x (-) = -

   (-) x (+) = -

   (-) x (-) = +

   (+) x (+) = +

   + ÷ + = +

   + ÷ - = -

   - ÷ + = -

   - ÷ - = +

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PROJECT EFFECT

Algebra Review IUSB

EQUATIONS: (Notes)

1. An equation is an algebraic statement that two quantities are equal.

2. In an equation, the algebraic expression or quantity to the left of the equal sign is referred to as the left side or left member, of the equation, and the expression or quantity to the right of the equal sign is the right side, or right member of the equation. The letter number whose value is to be found is called the unknown.

3. To solve an equation you find the value of the unknown which when substituted for the unknown in the original equation, makes both sides of the equation equal. The answer you obtain is called the root of the equation.

Examples:

$x = 10 + 4$

$x + 2 = 13$

$x - 8 = 2$

$m + 15 = 16$

$10n = 2$

$4n = 40$

$a/100 = 100$

$5x + 12x = 14$

$x + x + 2x - 2 = 0$

$1/2x + 1/2x - 1 = 0$

$1/4x = 10 - x$

$9d + 16 = 20 - d$

$2/3x = 30$

$x + x = 12$

$13a + 9 = 9$

$2b - 14 = 44$

PROJECT EFFECT
IUSB
BASIC MATHEMATICS: DIAGNOSTIC EX. I

INSTRUCTION: Answer as many questions as you can within the time allotted.

1. a) $+9 -(+18) =$ c) $-1 -(-3) =$

   b) $(+2)(-3) =$ d) $6 \times 7 =$

2. Convert the following into decimals:

   a) $2/3 =$ c) $5/6 =$ e) $29/50 =$

   b) $3/4 =$ d) $7/10 =$ f) $13/20 =$

3. Simplify:

   a) $\frac{(+4)(-3) + (-2)(-5)}{-7 +5 +2 -6 -9} =$ b) $\frac{(-2)^2 -8 +6 -5 -5 -3}{2 -3 +4 -5} =$

   c) $5 [3x -2 (5x +7)] -9 =$ d) $\frac{2x +10}{x +5} =$

   e) $4(x + 3) =$

4. Put a cross mark (x) beside each of the following if it is not an appropriate translation for the algebraic expression: $x + 5(x + 3)$.

   a) The sum of the ages of a father and his son if the father's age is five times 3 years more than the son's age. (a) ____________

   b) The total value of a sum of money consisting of pennies and nickels is three more than the number of pennies. (b) ___________

5. A car is checked for mileage per gallon and found to get 23 miles per gallon on straight turnpike driving. How far will it go on a tankful, if the tank holds 18 gallons?

6. Think a number tricks:

   Think of a number, add 5; multiply by 2, subtract 4; multiply by 3; add 24; divide by 6; subtract the original number. What answer have you got?

PROJECT EFFECT
IUSB
BASIC MATHEMATICS: ALGEBRA EX. #2

STUDENT'S NAME ____________________________________

1. Add the terms that are alike by combining their coefficients; for those that are unlike simply indicate their sum.

i)	3x	2a	a	2a	a	7d
	4x	5a	a	3b	b	d
	____	____	____	____	____	____

ii)	mn	2x	4k	$5a^2$	xy	ab^3
	mn	8y	10	$3a^2$	3xy	$2ab^3$
	____	____	____	____	____	____

iii)	3a	am	1 1/2x	x^2y	2.1a
	4a	am	2 1/4x	x^2y	3.2a
	5a	am	5 1/2x	$3x^2y$	6.0a
	6a	am	4 3/4x	x^2y	3.8a
	____	____	____	____	____

2. $2a + 3b + b =$ $\qquad$ $9k + 10k + k =$ $\qquad$ $a + b + y =$

$2s + S^2 + 3s + 4 =$ $\qquad$ $3x^2y + 2x^2y + x^2y =$

3. What is the sum of 3m, 4m and 10m? ____________________

What is the sum of y, 3y, 4y and y? ____________________

What is the sum of x, 3x and 3? ____________________

What is the sum of y -10 and 10a? ____________________

What is the sum of 2a, 8a and 4b? ____________________

What is the sum of a^2, a and 2a? ____________________

PROJECT EFFECT
IUSB
BASIC MATHEMATICS: ALGEBRA EX. #3

STUDENT'S NAME ______________________________

1. Perform the indicated operations, that is, combine terms that are alike:

$6d - 3d + 2d =$	$5a - a + 2a =$
$m + m - m =$	$ab - (-ab) + 3ab =$
$7x^2 - 2x^2 - x =$	$- 3ab^2 - 2ab^2 + ab^2 =$
$x^2 + 3x^2 - x^2 =$	$x^2 - (-x) - x =$
$a^3b - 2a^3b + a =$	$20 - xy - 10 - x =$
$a^2 - a^2 + 2a^2 =$	$3c - (-2/3c) - (-1/4c) =$

2. Multiply:

$8x$	$10a^2$	$13b$	$19c$	$11ab$
$3x$	$5a$	3	$3c$	ab
____	____	____	____	____

$4ab$	$8a$	$6x$	$14d$	$9mn$	$-xy$
$10ab$	$7a$	$9x$	$4d$	mn	$-xy$
____	____	____	____	____	____

$2a \cdot 3a =$ $4x \cdot x =$ $ab \cdot ab \cdot ab =$

$3f \cdot 2f : 5 =$ $1/4h \cdot 1/2h \cdot 1/2 \cdot h =$ $6y : 5y =$

3. Find the product of:

i) $-x$ and $3x$ =
ii) $1/4a$ and $1/4b$ =
iii) $-x$, $-3x$ and $10x$ =
iv) 5, $3a$ and $4b$ =
v) k and k2 =

PROJECT EFFECT
IUSB
BASIC MATHEMATICS: ALGEBRA EX. #4

STUDENT'S NAME ____________________________________

Perform the following divisions:

1. $\frac{x^2 - 2x - 3}{x + 1} =$

2. $\frac{x^2 + 2x - 3}{x - y} =$

3. $\frac{x^2 - 8x + 15}{x - 3} =$

4. $\frac{15x^2 + 16x - 15}{3x + 5} =$

5. $\frac{x^2 - y^2}{x + y} =$

6. $\frac{x^2 - y^2}{x - y} =$

7. $\frac{x^3 + a^3}{x + a} =$

8. $\frac{x^3 - c^3}{x - c} =$

9. $\frac{x^4 + 2x^3 - x^2 + 4}{x + 2} =$

10. $\frac{x^5 - 8x^2 - x + 2}{x - 2} =$

PROJECT EFFECT
IUSB
BASIC MATHEMATICS: ALGEBRA EX. #6
REVIEW EXERCISE

1. Evaluate the following algebraic expressions if $a = 1$, $b = 2$, $c = 2$:

   a) $a + b + c =$

   b) $3\ (a + b) =$

   c) $abc - 6 =$

   d) $\dfrac{c - (b + a)}{a - (-\ b)} =$

   e) $c + (b + c) =$

2. Simplify these expressions by applying the rule of subtraction or addition as required:

   a) $(-\ 4x) - (-\ 2x) =$

   b) $(-\ 6x) - (-\ 4x) =$

   c) $(-\ ab) + (-\ ab) =$

   d) $(+\ 2x) + (-\ 8x) =$

   e) $(6xy) - (-\ 6xy) =$

3. a) Multiply:

   i) $(x - 4)$ by $(x - 2) =$

   ii) $(2x^2 - 4x - 8)$ by $(3x - 5) =$

   b) Divide:

   i) $a^2 + 8a + 15$ by $a + 5 =$

   ii) $n^2 - 10n = 39$ by $n - 13 =$

   iii) $a^2 - 2a - 1$ by $a - 1 =$

4. If $A = x - 1$, $B = x - 2$, $C = 2x + 1$, find the value of:

   i) $A + B + C =$

   ii) $(A + B)\ (B + C) =$

   iii) $(A - C)$ by $(A - C)$

5. Solve the following equations:

   i) $x + 2 = 13$

   ii) $13a + 9 = 9$

   iii) $x = 10 + 4$

   iv) $m + 15 = 16$

   v) $5x + 2x = 14$

BASIC WRITING

The following materials are used to meet the Basic Writing module objectives in Volume i (p. 19).

Objective	Resource
1	The Little English Handbook, E.J. Corbett, J. Wiley & Sons, Inc., 1973, 1977.
2	Planning Worksheet, from instructor Resource A.
2	Writing Strategies, from instructor Resource B.
2	Reports checklist, from instructor Resource C.
2	Writing Problems, from instructor Resource D.
3	Survival article - Resource E.
3	Lovins'article in Foreign Affairs magazine Resource F (detailed reference in Energy Overview module).
4	The Little English Handbook, Resource G.
Evaluation	Instructor's assessment of students' progress based on class assignments.

PLANNING WORKSHEET

Basic Writing

PRELIMINARY QUESTIONS

What is it? ______________________________

______________________________ (report, letter, etc.)

Who are the readers or listeners? ______________________________

____

Why am I preparing it? ______________________________

____

What are the restrictions? ______________________________

______________________________ (format, length, etc.)

When should it be ready? ______________________________

READER ANALYSIS	MAIN READER	OTHER READER
Position or title		
Level of technicality		
Attitude toward subject		
Mode or style preferred		

APPROACH

Mode ______________________________

Scope ______________________________

____

Point of View ______________________________

____

Tone ______________________________

____

General Format ______________________________

____

Basic Pattern ______________________________

____

WRITING STRATEGIES

Section 1: Direct Approach

Determining brand preferences and knowledge of competing brands, also learning their buying habits, then securing their reactions to the sample advertisements are the major topics for your session with the consumer research panel.

The major topics for your session with the consumer research panel are determining brand preferences and knowledge of competing brands...

Section 2: Parallelisms

Nouns: I have notified McPherson, Jacogski, and Allen.

Adjectives: The project has been rejected because it would be unnecessary, expensive and impractical.

Prepositional Phrases: "government of the people, by the people, and for the people".

Verbal Phrases: Constructing the questions, conducting the survey, and tabulating the results took about a month.

Dependent Clauses: Because the design is faulty, because the production is costly, and because customer acceptance has been sluggish, the new model Edsel has been dropped.

Main Clauses: Labor approves, management approves, the government approves; thus the prospect for adoption looks good.

Whole Sentences: In past years, taking inventory has been a slow, time-consuming job. This year, the new procedure allowed us to finish in less than half the time.

Section 3: Coordinate Conjunctions

Words: labor and management; tired but happy

Phrases: to be or not to be; out of one crisis and into another

Dependent Clauses: after Donovan finishes his speech, but before Abbot begins his

Independent Clauses: Sales have increased, yet the future remains uncertain.
Scott has not given her approval, nor is she likely to.
I was reluctant to sign, for I had not forgotten the earlier problems.
Absenteeism remains high, so the special reports will still be required.

Section 4: Reducing Emphasis through Weaker Grammatical Structures

Two ideas: Jones was the best qualified candidate.
He received the appointment.

Section 8: (cont.)

In the misunderstanding of the meaning of another person, it is important to remember that in all probability the causes are many and varied.

One factor is more important in persuasion than any other. That factor is adapting to the need of the persuadee.

Some of the Suggestion Department's functions include the following: the gathering of all employee's suggestions, the routing of various suggestions to different departments and the investigation of suggestions that have been submitted.

Some of the Suggestion Department's functions include gathering employees' suggestions, routing suggestions to different departments, and investigating suggestions that have been submitted.

Section 9: Variety

The union represents the workers by means of a shop committee. The committeemen are chosen from among the workers by periodic elections. The various committeemen represent, after the election, specified districts within each plant. The districts are made up of various departments within the plant. The borderlines of each district are set up in each local contact between management and the union.

Sentence Structures:

Simple (single independent clause):
For Charlotte, N.C., the federal aid is considered especially timely.

Complex (one independent and one or more dependent):
If we can't somehow resolve this problem, we'll have to cut service and increase fare.

Compound (two or more independent clauses):
Federal operating subsidies will not make up for that loss; however, they could certainly help.

Compound-Complex (two or more independent clauses plus one or more dependent clauses):
A boost in bus fares has been suggested, but there is wide disagreement on whether this would increase revenues or drive away riders and put Metro deeper into the hole.

Variety in Arrangement:

Period: Such systems, once considered a detriment because areas around stations become run down, are getting a new image.

Loose: Such systems are getting a new image, although once they were considered a detriment because areas around stations became run down.

Section 4: Cont.

Equal: Jones was the best qualified candidate, so he received the appointment. (or "...candidate; therefore, he received...")

Reduced by subordination: Since Jones was the best qualified candidate, he received the appointment.

Jones, who was the best qualified candidate, received the appointment.

Reduced by Phrase: Jones, being the best qualified candidate, received the appointment.

The driver was distracted by a beautiful woman with long blonde hair, thus losing control of his care and being killed.

Section 5: Emphasis through Location

Since Jones was the best qualified candidate, he received the appointment.

Janes received the appointment becasuse the was the best qualified candidate.

Hruska was not even considered; Nitka's qualifications were unimpressive. Jones received the appointment because he was the best qualified candidate.

Without doubt, one of the most important reasons we are losing ground in owner loyalty is loss of contact with customers, in my opinion.

Section 6: Emphasis through Parallelism

The installation of a terminal at the No. 1 dock would eliminate the need for the general foreman to enter the parts information in Building 90, thereby saving approximately one hour per day. A portion of the load on Building 90 would be relieved, since installing a terminal would allow the receipt of purchased parts at Store #1. Also, the need to store parts on the dock until they receive zone tags would be eliminated.

The installation of a terminal at the No. 1 dock would provide three benefits. It would eliminate the need for the general foreman to enter the parts information in Building 90, thereby saving approximately one hour per day. It would allow the receipt of purchased parts at Store #1, thus relieving the load on Building 90. Finally, it would eliminate the need to store parts on the dock until they receive zone tags.

Section 7: Relationship of Ideas in Average Length Sentence

Because most of the new communities have no employment base, new roads must be built linking them to Phoenix.

Section 8: Conciseness

It is the general concensus of opinion that production of new markets will be substantially and significantly increased as a result of combining the new operations together.

REPORTS CHECKLIST

I. The Letter of Transmittal
  A. Let the letter of transmittal carry your warm greeting to the reader.
  B. Open quickly with a "Here is the report you requested" tone.
  C. Establish the subject in the first sentence.
  D. Follow the opening with a brief summary of the study. Expand the discussion if a separate summary is not to be included in the report.
  E. Acknowledge the assistance of those who helped with the study.
  F. Close the letter with a "thank you" and a forward look.

II. The Title Page
  A. Include on the title page:
    1. The title of the report.
    2. Full identification of the authority for the report (the party for whom the report is prepared).
    3. Full identification of the one who prepared the report.
    4. The date of the completion of the report.
  B. Use attractive layout. If the items are to be centered, leave an extra half inch on the left for binding. In other words, make sure the point from which you center your items is a little to the right of the actual center of the paper.

III. The Contents Page
  A. Use "Contents" or "Table of Contents" as the title.
  B. Use a tabular arrangement to indicate the heading degrees used in the report.
  C. If many graphs or tables are used, list them in a separate "List of Figures." Otherwise the graphs or tables should not be listed, because they are not separate sections of your outline but only supporting data within a section of the report.
  D. Center the entire content outline horizontally and vertically on the page.

IV. The Synopsis
  A. Use a one-word title, such as synopsis, summary, brief, or précis.
  B. Prepare the synopsis as a condensation of the major sections of the report.
  C. Concentrate on writing effective generalized statements that avoid detail available in the report itself. Simply tell the reader what you did, how you did it, and how it all ended.

V. The Body of the Report
  A. In writing style:
    1. Avoid the personal "I" and "WE" pronouns generally. Minimize the awkward use of "the writer" or "the author."
    2. Use active construction to give emphasis to the doer of the action; use passive voice to give emphasis to the results of the action.
    3. Use proper tense. Try to write the report as though the reader were reading it at the same time you are writing it.
    4. Avoid ambiguous pronoun references. Use as few sentences beginning "There is," "There are," and "It is" as you can.

RESOURCE C

  5. Tabulate lists of three items or more if the tabulation will make reading easier.
  6. Use transition words to give paragraphs coherence.

B. In physical layout:
  1. Use headings to assist the reader by making them descriptive of the contents of the section
  2. Use parallel construction in headings.
  3. Try to incorporate the statement of the problem or purpose and method of research as minor parts of the major introductory section unless the research method is the unique element in the study.
  4. Arrange margins in this way: top, one inch; right, one inch; bottom, one and one-half inches; left, one and one-half inches (the extra half inch is for binding).
  5. Number all pages, with the first page of the body of the report being page one. For pages having a major title at the top, omit the number or place it in the center of the bottom of the sheet, two spaces below the last line. For all other pages, place the number in the center of the line or in the upper right corner a double space above the first line on the page, or center the number a double space below the last line on the page.

C. In using graphics or tabular data:
  1. Give each graph or table a descriptive title.
  2. Refer to the graph or table within the text discussion.
  3. Place the graph or table as close to the textual reference as possible and limit the text reference to analysis. It should not merely repeat what can be seen in the graph or table.

D. In reporting your analysis:
  1. Question each statement for its contribution to the solution of the problem. Is each statement either descriptive or evaluative?
  2. Reduce large, unwieldy numbers to understandable ones through a common language, such as units of production, percentage, or ratios.
  3. Use objective reporting style rather than persuasive language; avoid emotional terms. Identify assumptions and opinions. Avoid unwarranted judgments and inferences.
  4. Document your report wherever necessary.

E. In drawing conclusions:
  1. State the conclusions carefully and clearly, and make sure they grow out of your findings.
  2. If you believe it necessary, repeat the major supporting findings for each conclusion.
  3. If recommendations are called for, make them grow naturally from the conclusions.

VI. Documentation

A. When in doubt, footnote the material or the source.
B. Plan the placement of the footnote in advance so it doesn't run off the page or even below the bottom margin.
C. Prepare the bibliography in alphabetic sequence by author.
D. If the bibliography is lengthy, include separate sections for books, articles, governmental publications, and unpublished references.

WRITING PROBLEMS

Section 1:

After three months of searching for the best possible president, the board of directors finally chose J. Huntington Wilkes. A thirty-year company employee, currently working as a janitor.

We had good reason to be disappointed. Having worked on the project for six months.

Since miniaturization has made microcircuitry possible. We should consider remodeling our system to make better use of available space.

The department will have to have the specifications for the brake system redrawn and resubmitted. With more care exercised to include all auxilary systems and options.

All their efforts were directed toward one goal. To attain the highest possible market share.

Section 2:

The managerial responsibilities embrace an hourly production work force of 705 persons, 84 maintenance personnel, and 45 salaried individuals of various grade levels, all of whom are involved in producing cores made from sand, such as one might find on lake shores.

All bills for payment which must fulfill audit requirements numbers one and two, as explained above, are received by messenger, inter-company mail, or U.S. mail, at an average rate of approximately 2,000 daily, but it is physically impossible to perform a 100 percent audit and still conform to commission regulations.

Section 3:

Upon expiration of the period for which full salary is paid, payment will be reduced to an amount equal to 60% of your base salary, as indicated in the letter dated 2-26-77, Social Security Disability Benefits awarded are integrated by the company and our insurance carrier.

The third proposed solution was the "Employee Reward" plan, the reward plan was intended to improve employee performance.

Section 4:

The entire crew has followed the instructions precisely given in the operational manual.

The policeman who broke his arm yesterday returned to work.

Miss DuClerq is only a secretary to Mr. Grossmeyer.

Section 5:

Arriving early for my interview, the Personnel Office was not open.

Minding my own business, the machine stopped suddenly.

Sitting at my desk, the supervisor walked into my office.

To be certain, the legal staff should be consulted.

Section 6:

Landis tried to more fully comprehend the implications of the problem.

Smith hoped to with distinction handle the assignment.

Section 7:

I was early in the week asked to investigate the matter.

Liberty Mutual was after a long bout of negotiations given the account.

Because the patient was barely breathing, the doctor was called back into the room.

While Kirby has occasionally let us down, over the years he has built a reputation for dependability.

Section 8:

The reason for an initial planning session followed by the three-page questionnaire with in-depth interviews with selected respondents and finally a written report based on the interviews, plus a computer analysis of the questionnaire, is that this is the method found to be most effective.

In this report, I shall relate an interesting grievance that I, through the advice of my supervisor, decided to read.

Section 9:

As of today, there are no requisitions in File 3 for any of these audit forms. Where are they?

Fooster disliked his boss because he thought he was undependable.

To have a successful career at Liberty Mutual, one must learn how they do things.

Section 10:

October has been a disappointing month for sales, and morale has remained high.

Both John and Mike have proven very satisfactory in their new assignments; however, they will soon be considered for promotion.

Section 11:

A new employee should first be certain he understands the supervisor's directions, since you can get off to a bad start otherwise. It will probably take you two or three days to learn a new routine. Once he has mastered it, however, you will experience a feeling both of satisfaction and letdown.

The questionnaire responses will arrive at the rate of 10-15 a day. We processed them promptly and report on the results.

Section 12:

Conducting the survey involved deciding on the questions we actually would use, after first collecting as many questions as we could, then analysing the results once we had them tabulated.

Section 13:

This regulation will tie the hands of former supervisors for the next 30 years.

He was absolutely right to a certain extent.

PROJECT EFFECT
IUSB
BASIC WRITING

You have been put in charge of the only fall-out shelter in Hawaii, after an atomic bomb has destroyed all life elsewhere in the world. Ten people have shown up to be saved, but, because of the amount of air and food available in the shelter, you can only choose six people. You will spend four to five months in the shelter, and you have to decide which people could live together in that confined space, in addition to which people would be best to start a new civilization. These are the people:

1. 50 year old scientist, male, good health;

2. 45 year old doctor, female, good health;

3. 35 year old master carpenter, male, divorced, spent time in prison for armed robbery, good health;

4. 30 year old musician, with instrument, good health;

5. 25 year old prostitute, drug addict;

6. 15 year old pregnant girl, very low IQ;

7. 50 year old farmer, male, good health;

8. 25 year old nun, good health;

9 &
10. 28 year old lawyer and his 24 year old wife, a school teacher who cannot bear children - neither will enter without the other.

Assignment: Write a short essay listing the people you would choose to save and briefly explain why.

PROJECT EFFECT
IUSB
BASIC WRITING

FOREIGN AFFAIRS

Yet these kinds of delay are exactly what we can expect if we continue to devote so much money, time, skill, fuel and political will to the hard technologies that are so demanding of them. Enterprises like nuclear power are not unnecessary but a positive encumbrance for they prevent us, through logistical competition and cultural incompatibility, from pursuing the tasks of a soft path at a high enough priority to make them work together properly. A hard path can make the attainment of a soft path prohibitively difficut, both by starving its components into garbled and incoherent fragments and by changing social structures and values in a way that makes the innovations of a soft path more painful to envisage and to achieve. As a nation, therefore, we must choose one path before they diverge much further. Indeed, one of the infinite variations on a soft path seems inevitable, either smoothly by choice now or disruptively by necessity later; and I fear that if we do not soon make the choice, growing tensions between rich and poor countries may destroy the conditions that now make smooth attainment of a soft path possible.

These conditions will not be repeated. Some people think we can use oil and gas to bridge to a coal and fission economy, then use that later, if we wish, to bridge to similarly costly technologies in the hazy future. But what if the bridge we are now on is the last one? Our past major transitions in energy supply were smooth because we subsidized them with cheap fossil fuels. Now our new energy supplies are ten or a hundred times more capital intensive and will stay that way. If our future capital is generated by economic activity fueled by synthetic gas at $25 a barrel-equivalent, nuclear electricity at $60-120 a barrel-equivalent, and the like, and if the energy sector itself requires much of that capital just to maintain itself, will capital still be as cheap and plentiful as it is now or will we have fallen into a "capital trap"? Wherever we make our present transition to, once we arrive we may be stuck there for a long time. Thus if neither the soft nor the hard path were preferable on cost or other grounds, we would still be wise to use our remaining cheap fossil fuels - sparingly - to finance a transition as nearly as possible straight to our ultimate energy-income sources. We shall not have another chance to get there.

Assignment: Explain in your own words the main idea(s) developed in these two paragraphs.

PROJECT EFFECT
IUSB
BASIC WRITING

EDITING

1. (pp. 13-17) Are the subjects and verbs in agreement? Singular subjects take singular verbs, and plural subjects take plural verbs.

2. (pp. 23-24) Are there any dangling modifiers? The introductory word or phrase must belong to the subject of the sentence.

3. (pp. 31-35) Are all the sentences complete? There should be no sentence fragments.

4. (pp. 35-39) Are any sentences combined with a comma or without punctuation? There should be no run-on sentences.

5. (pp. 40-47) Are you able to make sense of all the sentences? If you cannot figure out what the writer meant to say, then there is some flaw in either the choice of words or in the order of the words in the sentence.

6. (pp. 48-55) Are all the words precise, accurate, and objective? Make sure that the words used fit the subject matter and the audience.

7. (pp. 57-60) Are there any unnecessary words? The writer should not use more words than needed, and he should avoid repetition.

8. (pp. 65-76) Are the paragraphs unified, coherent, and complete? Make sure that each paragraph has a topic sentence and that all other sentences relate to it in a logical order.

9. (pp. 77-105) Are the sentences punctuated correctly? Check the appropriateness of the commas, semicolons, colons, apostrophes, and dashes.

10. (pp. 218-219) Are there any misspelled words? Read the selection backwards, beginning with the last word and ending with the first.

RESOURCE G

ENERGY OVERVIEW

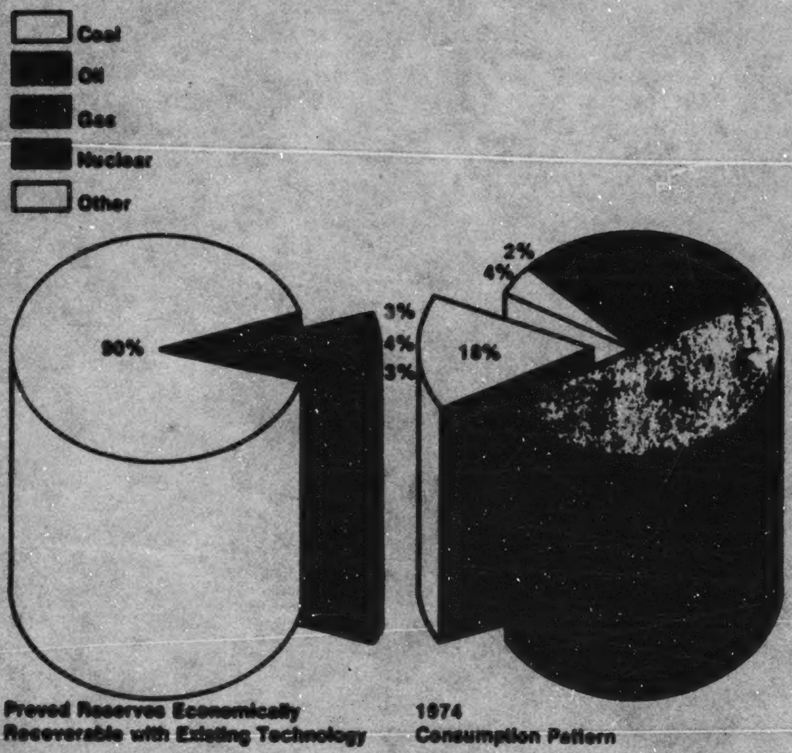
The following materials are used to meet the Energy Overview module objectives in Volume i (p. 22).

Objectives	Resource
1	Energy term search using library resources.
2	Tour of local Nuclear generating station.
2	Handout on "Secure Storage of Radioactive Waste", EPRI Journal, Jul.-Aug. 1976 pp. 6-14.
3	Lecture material and slide presentation Resource A.
3	Energy and Society, T.J. Healy, Boyd and Fraser Publication Co., San Francisco, 1976, chapter 2, 3, 8, 9 15.
3	"Survey of World Energy Resources, Energy Sources for the Future", M. King Hubbert, CONF 750733, ORAU, Oak Ridge, TN 1975.
4	"Energy Strategy: The Road Not Taken?" Amory B. Lovins, Foreign Affairs Quarterly, October 1976.
4	Handout explaining debate activity on Lovins' article Resource B.
4	"Energy: Social and Political Aspects", F.S. Patton, and "Energy Sources of the Future", J.P. Sanders, "Energy Sources for the Future", CONF 760744, ORAU, Oak Ridge, TN 1976.
4	Energy Environment Simulator Activity Resource C.
5*	Direct Use of the Sun's Energy, Farrington Daniels Ballantine Bks, NY, 1964, Chapters 2 & 3 The Solar Home Book, Bruce Anderson, Cheshire Bks, Harrisville, NH, Chapters 1 & 2, p.287, 292 & 293. Handout on analemma.

*Objectives 5-9 were added for the second year and therefore not included in Volume i.

Objectives	Resource
6	Solar Home Book, pp. 80, 82-88, 93, 116, 123, 131, 142, 150, 151, 166, 175, 181, 172, 176, 177, 178, 179.
7	Solar Home Book, p. 94, 142, 145, 180, 185, 186, 187, 190, 191, 192, 193, 194, 196, 259.
8	Solar Home Book, pp. 209-224.
9	Woodburner's Encyclopedia, Jay Shelton, Vermont Crossroads Press, Waitsfield, VT, 1976, Chapters 1-4, 6, 7 & 9.
Evaluation	Solar test Resource D.
Evaluation	Exam Resource E.

What Are the Roots of Our Energy Problem?



- The vast reserves of coal in the United States amount to three times the energy contained in the Middle East's oil reserves, and currently account for more than 90 percent of U.S. proved energy reserves.

- Yet, over the last 75 years, the United States has switched from using coal for over 90 percent of its energy needs to depending on oil and gas for 75 percent of its energy.

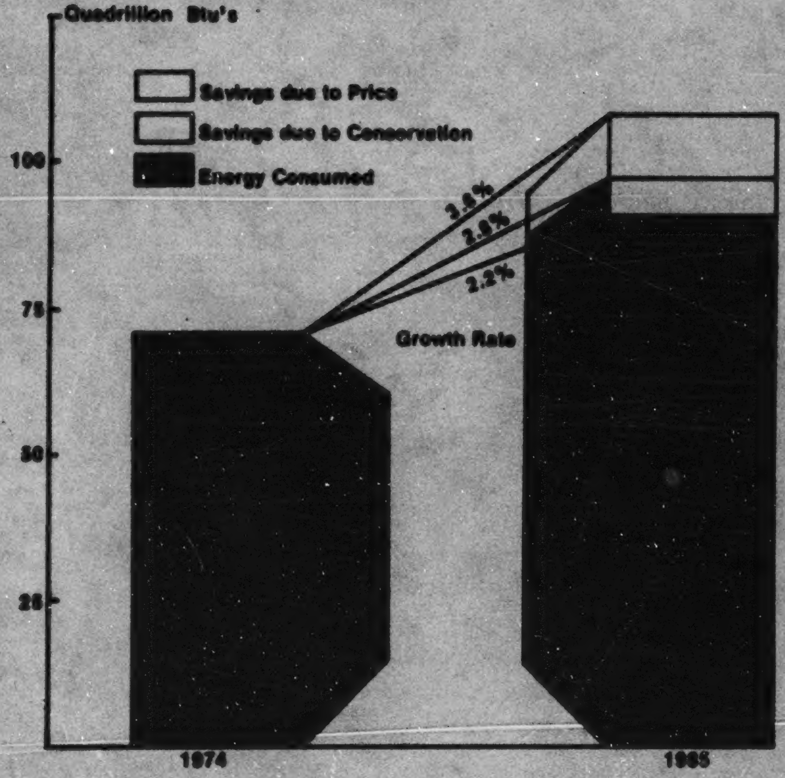
- Thus, *the Nation depends upon its least abundant energy resources to provide most of its energy needs.*

- The result has been a growing dependence on imported energy, the availability and price of which are controlled by a few Middle East countries.

- Our task between now and 1985 is to find and develop more oil and gas and stimulate conservation to offset currently dwindling production of these fuels, as our economy is converted to the more abundant resources, such as coal and nuclear power.

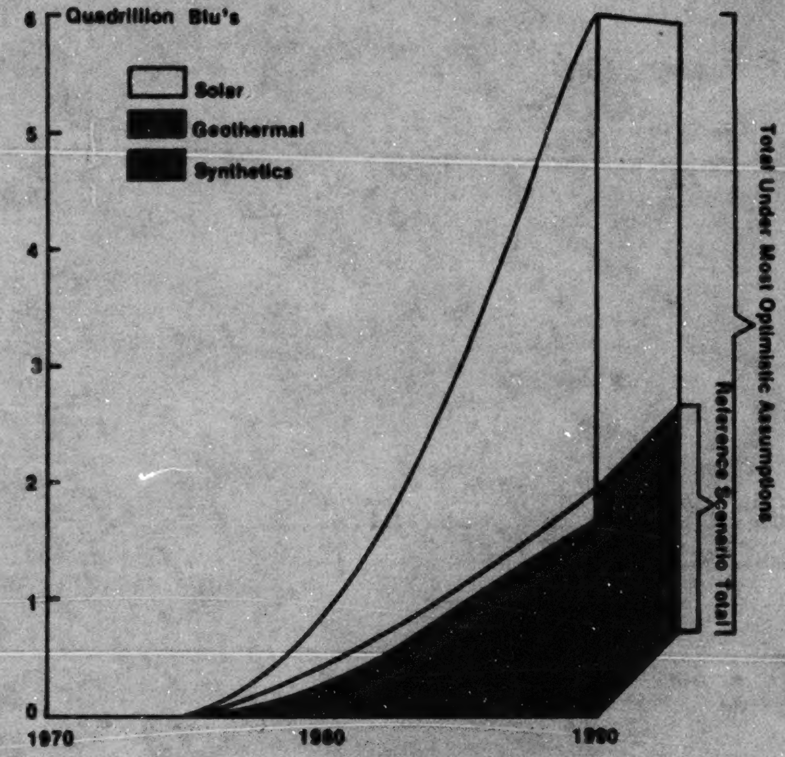
- In the post-1985 period, our task is to develop new technologies that can dramatically expand our economically usable reserves of shale oil and uranium, and to make greater use of nondepletable resources, such as solar and geothermal energy.

How Much Energy Can Be Saved?



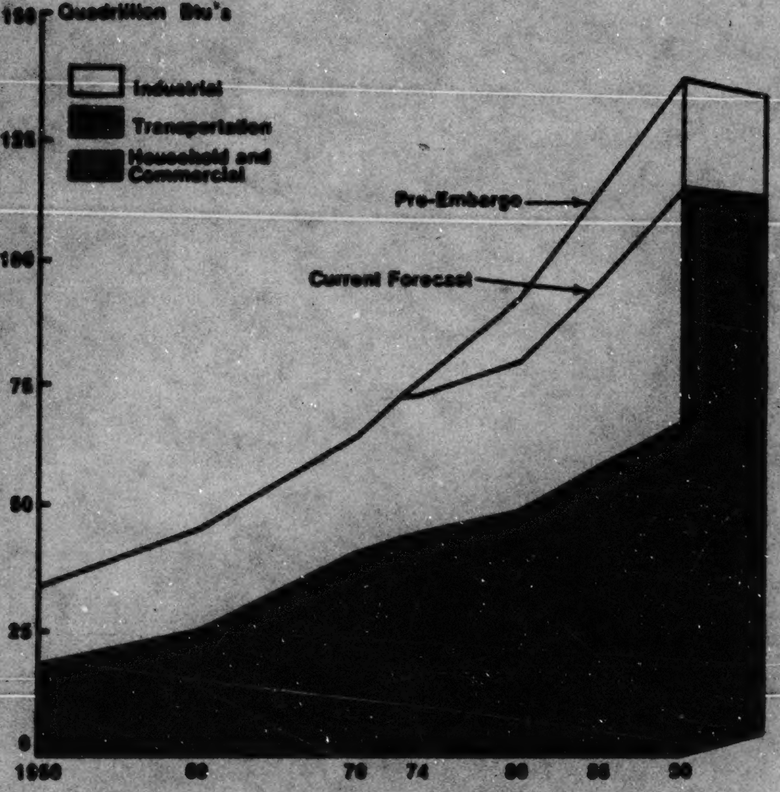
- Higher energy prices should significantly cut energy demand growth during the next 10 years, reducing the growth rate to 2.8 percent from the historical rate of 3.6 percent.
- *An active conservation program could further reduce energy demand by the equivalent of 3 million barrels per day*, reducing the annual energy growth rate to 2.2 percent through 1985.
  —Savings could be achieved in all the major sectors: residential, commercial, industrial, and transportation.
  —Actions which improve energy efficiency of automobiles, homes, and office buildings would have the greatest impact in the next 10 years.
- While conservation can reduce energy demand, it does not appear feasible to cut the growth rate to zero or to obviate the need for expanding existing supplies of energy.

How Much Can New Technologies Contribute?



- Solar, geothermal, and synthetic fuels will make only a small contribution to domestic energy supplies by 1985 (about 1 percent).
- *The major contribution from solar, geothermal, and synthetic fuels will not be felt until after 1990.*
- The technology for these sources exists, but must be proven economically viable on a commercial scale. It will take several years to build the first full-size plants; hence a large industry will not be possible during the next 10 years.
- It is likely that few, if any, synthetic fuel plants will be built by 1985 without Federal financial assistance.
- Unless commercial size plants are started now and proven economic by 1985, it will not be possible for these new sources to replace dwindling supplies of oil and gas in the post-1985 period.

How Much Energy Will the Nation Consume?



- Energy demand grew at a rate of 3.6 percent in the 20 years before the 1973 embargo, and in 1975 the United States consumed about 73 quadrillion Btu (quads).

  —Electricity consumption grew at twice the rate of all energy demand (about 7 percent per year).

- *By 1985, as a result of higher prices, energy demand will be much lower*—even with economic expansion—*than if historic growth rates had continued.*

  —With a continuation of current oil prices (about $13 per barrel in 1975 dollars), demand will be 98.9 quads in 1985—a 2.8 percent growth rate.

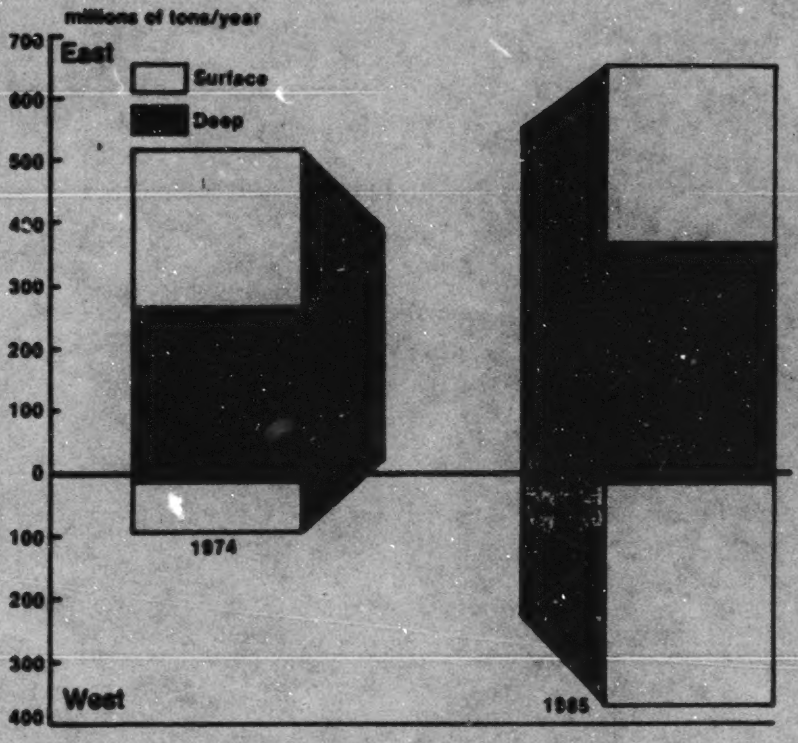
  —Electricity will still grow about twice as fast as overall energy demand, but at reduced levels of 5.4 percent per year.

  —Consumption will gradually shift from oil and gas to coal and nuclear power.

- If world oil prices decline to $8 per barrel, or if oil and gas prices are regulated substantially below market prices, energy demand will grow faster—at an annual rate of between 3.0 and 3.2 percent.

- The greatest reductions in energy growth will be in the Household/Commercial and Transportation Sectors, which will respond most sharply to higher energy prices.

Where Will New Coal Production Come From?



- *Coal production is projected to increase from 603 million tons in 1974 to 1040 million tons in 1985.*

  —Coal production will increase more slowly if long-term utility demand is uncertain and if major environmental and transportation issues are unresolved.

  —More coal probably could be produced, but will not be because its markets are limited primarily by the growth in electric power and synthetic fuels.

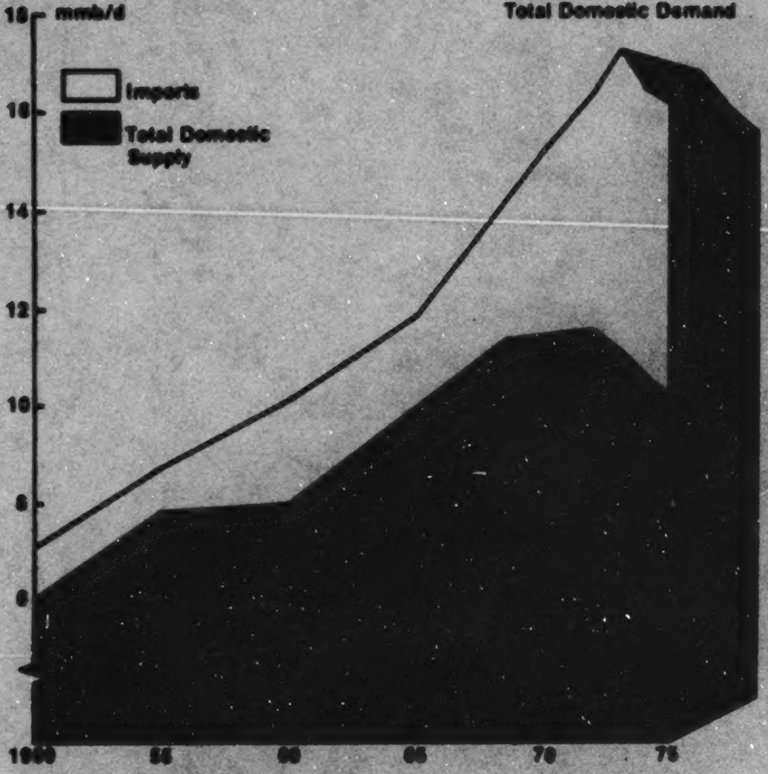
- *The major expansion of production will occur in the Western regions*, increasing from 92 million tons in 1974 to about 380 million tons in 1985.

  —Western coal production will continue to be mainly surface mining.

- *Eastern mining could expand by about 30 percent.*

  —Underground mining should reverse recent trends and increase more than surface mining in the East, since low-cost surface reserves are being depleted.

How Did We Become So Vulnerable To Oil Imports?



- The availability of inexpensive imported oil served as a disincentive to domestic production, which peaked at 9.6 million barrels per day (MMB/D) in 1970, has been declining ever since, and now stands at 8.2 MMB/D.

- Meanwhile, petroleum demand grew at an annual rate of 4.6 percent in the 1960's and early 1970's, in response to low prices, air pollution restrictions on coal use, and the growing use of automobiles.

- The combination of declining domestic production and rising demand led to a rapid growth in imports:
  —From 1.8 MMB/D, or 19 percent of consumption, in 1960.
  —To 3.4 MMB/D, or 23 percent of consumption, in 1970.
  —To 6.0 MMB/D, or 37 percent of consumption, in 1975.

- The Arab oil embargo in 1973/74 demonstrated that the United States is vulnerable to severe supply disruptions and oil price increases.

- Today, the United States spends about $27 billion, or $125 per person, for imported oil; as compared with about $3 billion, or $15 per person, in 1970.

ACTIVITY -- THE ENERGY PATH FISH-BOWL

Part I Background lectures on Hard path technology

Part II Research and work session on the Lovin's article and related materials

Part III Fish-bowl

Objectives

1) Trainees will be able to distinguish between a. the hard energy path and b. the soft energy path (and which technologies belong where).

2) Teams will develop five questions getting at the short-comings of the opposite approach to the energy situation (hard vs soft).

3) Teams will develop a comprehensive listing of advantages favoring their appointed path toward solution to the energy situation (hard vs soft).

4) .....address (rather directly) confrontation of their position toward energy conservation

Follow-up debate scheduled
(time allowed for additional research of subjects)

Energy Path Fish-Bowl

Overview and five minute summation statements from each team

Questions of each team:

A) to hard path team Lovin's alludes to some social ills associated with a shift to the soft path. Do you anticipate any significant *social ills* associated with a continuation of the present path?

B) to soft path team Are the hard path and the soft path compatible? Why or why not?

Four Questions to the Hard Path Team

1) Why is nuclear a clean and healthy source of energy?

2) Considering the push for more coal-fired electrical generation, what will be the ultimate effect of CO^2 on the biomass?

3) What will U.S. do if other countries refuse to send us oil?

4) What provisions do you have for alternate energy sources when fossil fuels and nuclear sources are exhausted?

Four Questions to the Soft Path Team

1) What would be the representative cost of domestic solar energy per KWH of electricity produced?

2) How can you expect to change the pattern of American's energy habits?

3) Where will the money come from for solar development?

4) Why don't the *softies* want nuclear energy?

Reflections:

1) Hard path team had more convincing argumentation.

2) What made Lovin's position so convincing? He stuck with the *facts*! Argued *rationally* and *objectively*.

3) Stick with FACTS. Convince the HEAD, not just the HEART.

RESOURCE B

ENERGY - Environment Simulator Activity

The Decision-Making Process

Introduction and Overview

RUN #	STOP ON SHORTAGE	TIME SETTING (YEARS/MINUTES)
1 - self run	no	25
2 - zero population and personal energy demand growth	no	100
3 - self run - no step-back	no	100
4 - regular population & Personal energy demand (step back population and personal energy demand)	yes	100
5 - CHANGE MODE - each board controls one area of supply and/or demand	no	25
6 - Same as run #5 with step-back of population and personal energy demand	no	100

Summary and Discussion

end of each run record

1) # of years elapsed

2) general environmental situation

3) are coal, oil and natural gas completely gone?

4) what is the personal energy demand number?

ENERGY - Environment Simulator Activity

As a result of this activity, the trainees will be able to:

1) Discuss some of the major trade-offs in making energy use (or non-use) decisions.

2) Explain the need for communication across all sectors of our society relative to energy use in this country.

3) Explain how energy use reflects (and affects) living standards in this country.

4) Discuss the complexity of decision making as it relates to the U.S. energy picture.

5) Explain why we must expend energy (and money) now to develop energy resources for the future.

PROJECT EFFECT

Energy Overview - Solar and Wood Quiz

February 27, 1979

PART I (50 points)

From the list provided below choose the proper term or number that best fills in the blank. You are allowed to use the same answer more than once. Answers are not necessarily grammatically correct in relation to the rest of the sentence.

above
absorber
absorbs heat
absorptance
active
air gap
albedo
area
below
Btu output
clarity of atmosphere
creosote
Dark paint
day of year
degree days
density
direct
doors
east
efficiency
emittance
flatplate
fresnel lens
greenhouse
heat capacity
heat storehouse

heat trap
heliostat
high
hour of day
indirect
integrated
irregular
latent heat
latitude
north
ozone
passive
placement
pyranometer
radiation
reflects heat
releases heat
season of year
selective surface
solar collector
solar constant
solarometer
south
specific heat
sunny days

thermal mass
thermosiphoning
thickness
time of day
trapping heat
turbulent
umbrella
volume
weight
west
windows
0, ½, ¼, 1, 2, 3,
10, 30, 35, 40, 41, 45,
50, 54, 56, 57, 60, 65,
90, 128, 200, 240, 330, 2200,
3000, 4000, 8000, 10000, 30000,
40000, 100000, 200000

Project EFFECT -
Energy Overview - Solar and Wood Quiz
Page 2

1. In the upper latitudes (greater than 40^{0} N), South sides of houses receive nearly ____________ as much solar radiation in winter as in summer.

2, 3. The most significant factors in capturing the sun's energy for direct solar heating of a home are the size and __________ of __________.

4. In most areas of the U.S. , double clear glass windows on the ____________ side provide optimum winter heat gain.

5. The amount of solar radiation striking the outer atmosphere of the earth is known as ____________.

6. We say that massive houses, whose indoor temperatures do not respond quickly to fluctuations of outdoor temperature have a large ____________.

7, 8, 9. When designing a house to make optimum use of direct methods of collection of solar energy, one should try to make the house act as a ____________, ____________, and ____________.

10. The natural physical movement of heat through a fluid, occurring when a warmer fluid rises and cooler fluid sinks, is known as ____________.

1,
, 13, 14. The maximum solar radiation striking one square foot of the earth's surface is ____________ Btuh/ft^2. This figure depends on five factors. List any three:
____________, ____________, and ____________.

15. The latitude of South Bend, Indiana is __________ ^{0}N.

16, 17. Any material ____________ as its temperature rises and ____________ as its temperature falls.

18. An instrument for measuring solar radiation is ____________.

19. ____________ is a special coating sometimes applied to the absorber plate in a solar collector. This coating absorbs most of the incoming solar energy and reradiates very little of it.

20, 21. Techniques of solar heating in which sunlight enters a house through the windows and is absorbed inside are known as ____________ or ____________ methods.

22. The type of solar collector that works best for the climate of South Bend is the ____________ collector.

23. As a general rule of thumb, if a collector has a selective surface, it should have ____________ cover plate(s).

24. When using polyurethane as insulation in a collector it is important to remember to have a ____________ between the back of the absorber plate and the insulation.

25. The optimum collector tilt for solar space heating at South Bend's latitude is ____________$^\circ$.

26. The optimum collector tilt for solar domestic water heating at South Bend's latitude is ____________$^\circ$.

27, 28. Techniques of solar heating or cooling in which the solar heat is collected exterior to the building and transferred inside using ducts or piping and, usually, fans or pumps, are known as ____________ or ____________ systems.

29, 30. In an air-type flat plate collector, it is desirable to have a ____________ flow of air across the absorber and a ____________ surface for the absorber.

31. In a rock storage bin there is usually a ____________ % void space between the rocks.

32, 33. The location of a rock storage bin must take into account its great ____________ and ____________.

34. If 1,000 pounds of water can store 20,000 Btu's as its temperature increases from 80° F to 100°F, how many Btu's can it store from 80° F to 120° F? _________

35. It is better to describe the heat storage capacity of a solar system as the number of ____________ of heating demand that a system can provide.

36. If 500 square feet of collectors can provide 50% of a house's heat, then 1,000 square feet should be able to provide 100%.
True or False (circle one).

37. In general, with a solar domestic hot water heater, one square foot of collector should be able to provide at least ____________ gallon(s) of hot H_2O per day.

38. The number of Btu's needed to raise the temperature of one pound of a material 1° F is called the ____________ of a substance.

39. The number of Btu's that can be stored in one cubic foot of a substance over a temperature use of 1° F is called the ____________ of a substance.

0, 41, 42. The Rock Solar home has ____________ square feet of collectors for space heating, ____________ square feet for domestic hot water, and a ____________ gallon storage tank.

43. A good seasonal output for one square foot of a solar collector would be ____________ Btu's per year.

44. A realistic overall seasonal efficiency for a good flat plate solar collector would be about ____________ %.

45. When venting a woodstove into the same chimney as a gas or oil furnace, the woodstove should be vented ____________ the vent of the furnace.

46, 47, To determine how much heat a woodstove can provide for a home, one needs to know the ____________ and ____________ of the stove.

48. When using a woodstove, a substance that can build up inside the chimney and possibly ignite is ____________.

49. The Btu content of a pound of air-dried wood is approximately ____________.

50. A cord of wood usually has about ____________ cubic feet of solid wood in it.

PART II Please show all work, as only partial credit will be given for answers only.

1) 20 points

Given: Chart below
Heat Loss/Degree Day 10,500 Btu

Find: The appropriate answers to the numbered blanks
The number of square feet of collectors needed to provide close to (±5%) 50% of the heating load.

	Collector Output But/ft	Degree Days F-days	Heat Loss MBtu	Solar heat Collected MBtu	Aux. Heat MBtu	Solar heat Used MBtu	% Solar Heated
Sept.	16,400	125	1.31	7.26	0	(1)	100%
Oct.	13,900	401	4.21	6.15	(2)	4.21	100%
Nov.	9,800	766	(3)	4.34	3.70	4.34	(4)
Dec.	8,600	1248	13.10	3.81	(5)	3.81	29%
Jan.	8,700	1382	(6)	(7)	(8)	(9)	(10)
Feb.	10,200	1234	12.96	4.52	8.44	4.52	35%
Mar.	12,500	1074	11.28	(11)	5.75	5.53	49%
Apr.	10,700	652	6.85	4.74	2.11	4.74	69%
May	10,900	264	2.77	4.82	0	(12)	100%
Totals	(13)	7146	75.03	(14)	39.95	(15)	(16)

(17) ____________ square feet of collectors will provide (18) ____________ of the heating demand.

Solve one of the following two problems. Please show all work, as only partial credit will be given for answers only.

2) (15 points) A house designed for passive solar heat collection has a Trombe wall facing south that measures 10 feet by 50 feet by 6 inches thick. At 7 p.m. on a particular day, the temperature of the wall is 80° F. From that time until 10 a.m. the next morning, the outdoor temperature averages 15° F., while the indoor air averages 65°F. If the house loses heat at a rate of 450 Btu/hr/°F, and there is no auxiliary source of heat, what is the temperature of the wall at 10 a.m. the next morning?

3) A. (15 points)

1. How much heat can a cubic foot of water store over a 45°F temperatute rise?
2. How many gallons of water are needed to store 250,000 Btu over a 45°F temperature rise?
3. How much would this amount of water weigh?

B. 1. How much heat can a cubic foot of rock store over a 45°F temperature rise?

2. How many cubic feet of rock are needed to store 250,000 Btu over a 45°F temperature rise?
3. How much would this amount of rocks weigh?
4. How much space would a storage bin this size take up?

PROJECT EFFECT

EXAMINATION

ENERGY OVERVIEW

(1) Define the following terms:

Kilowatt Hour (KWH)

Light Water Reactor (LWR)

British Thermal Unit (BTU)

Fissile Material

(2) Explain the following formula as it relates to Doubling Time and the Energy Crisis.

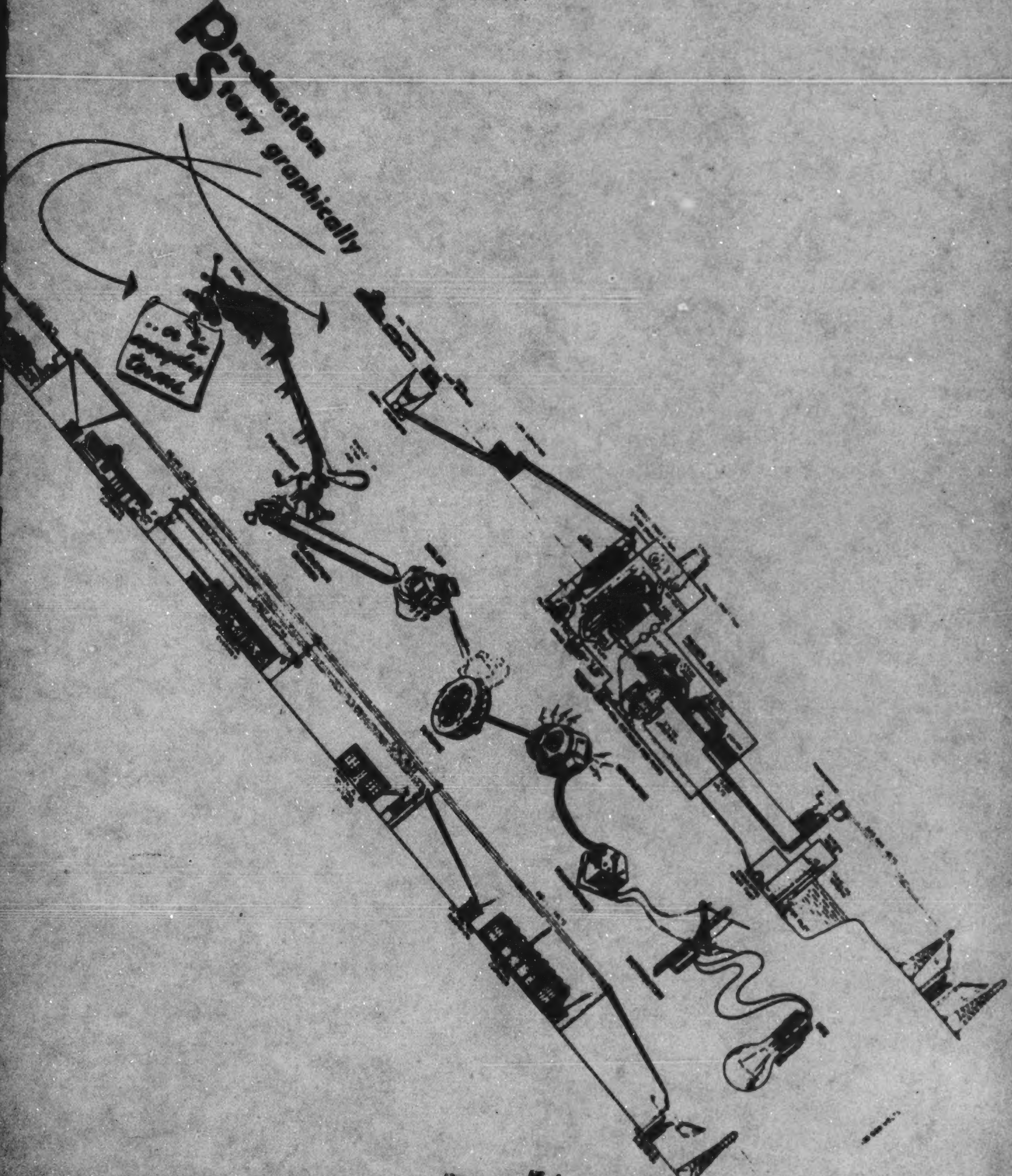
$$X = \frac{70}{\%\ \text{rate of growth}}$$

(3) a. Explain Lovin's distinction between "hard path" technology and "soft path" technology.

b. List and give advantages and disadvantages of three types of "hard path" technology and three types of "soft path" technology.

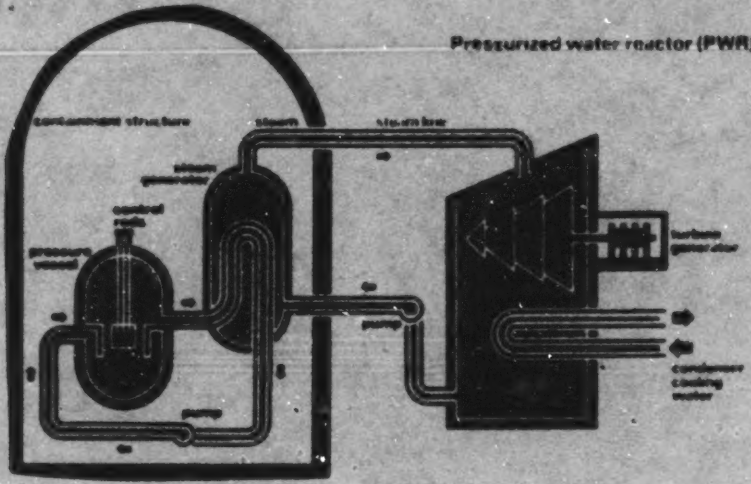
Project EFFECT
Examination
January 27, 1978

(4) In your own words explain the following diagram as it relates to the Second Law of Thermodynamics. (Answer on back of sheet)


Production
Story graphically

Project EFFECT
Examination
January 27, 1978

(5) Using the following diagram to help you, list the similarities and differences between nuclear power plants (e.g., Cook) and fossil fuel power plants (e.g., Twin Branch).


Pressurized water reactor (PWR)
containment structure
steam
steam line
steam generator
control rods
pressure vessel
pump
pump
turbine generator
condenser cooling water

(6) Define enrichment as it applies to the nuclear fuel cycle.

(7) a. In your own words state the first law of thermodynamics.

b. How is this law related to the Energy Crisis in the United States?

(8) a. In your own words explain the following figure:

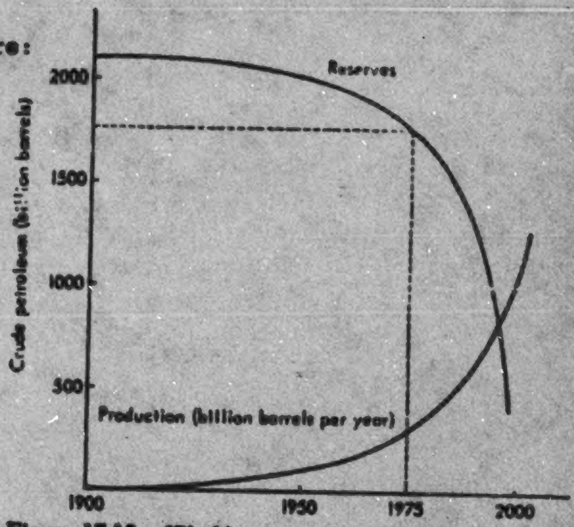
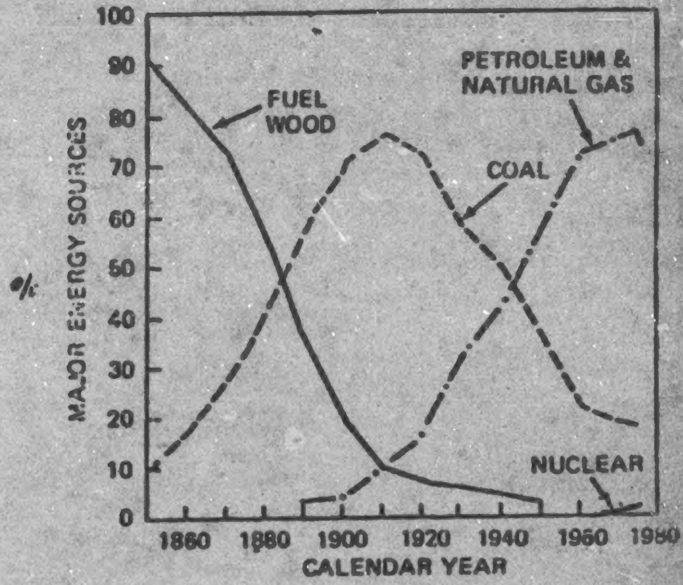


Figure 17-15. *World reserves of crude petroleum will not last long at current consumption rates. Note that in 1975, with no more than fifteen years left before demand exceeds supply, the total global reserve will have been depleted by only 12½ per cent.*

b. Why are the next twenty years so critical to the world energy picture?

(9) In your own words explain the following figure:



SOURCE: HISTORICAL STATISTICS OF THE UNITED STATES BUREAU OF THE CENSUS; U. S. BUREAU OF MINES, 1974

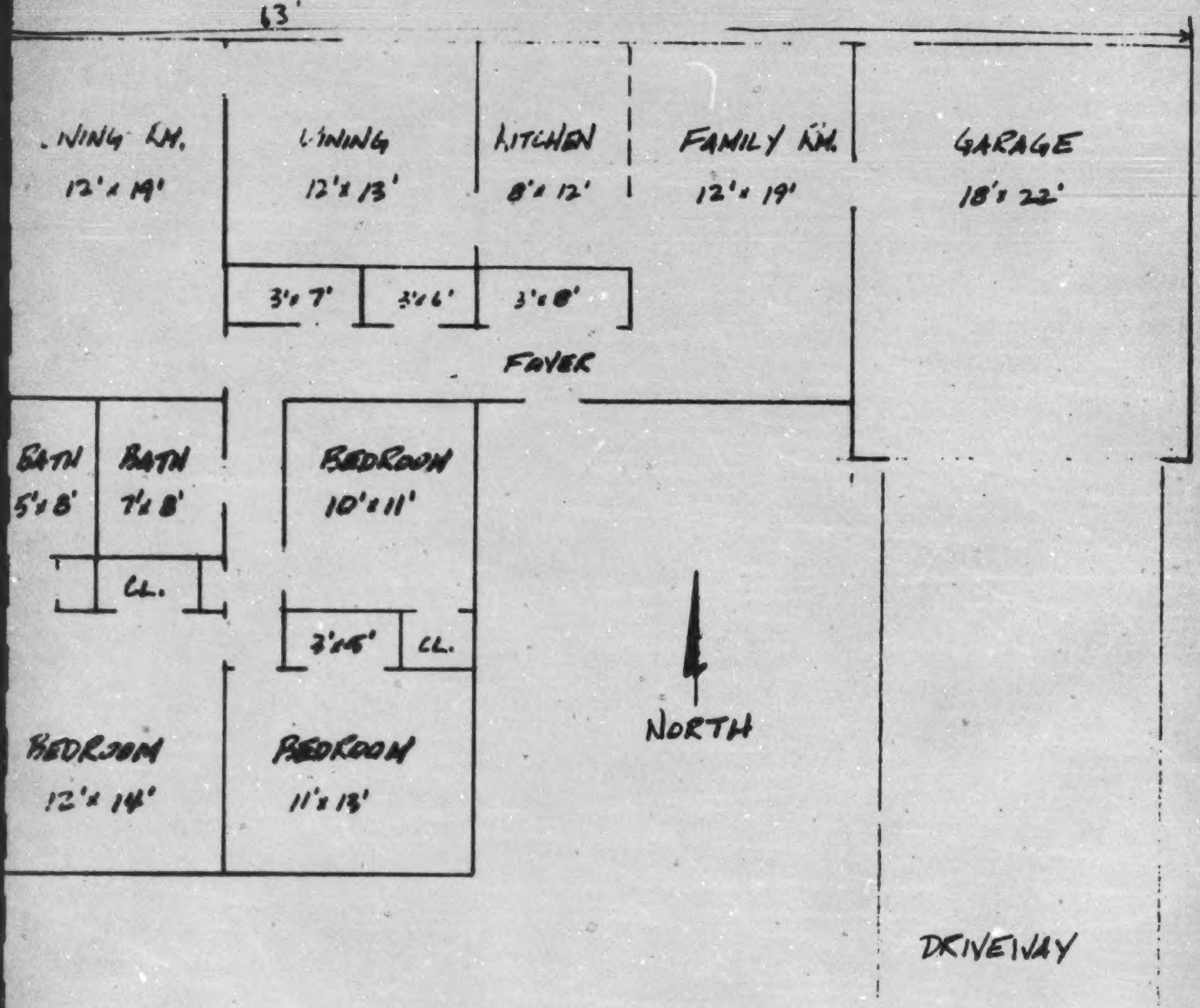
(10) a. List the four potential environmental effects of nuclear power generation discussed in class

0) b. Explain the importance of each of the four potential environmental effects.

BASIC GRAPHICS

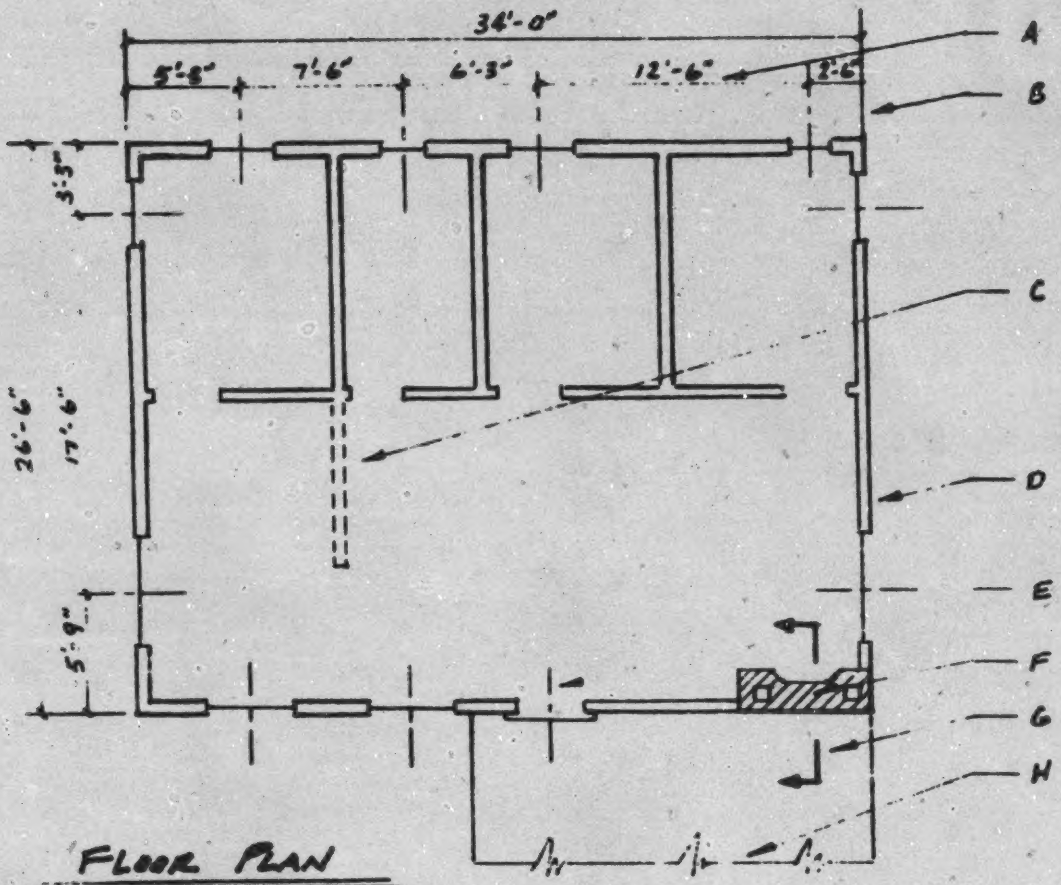
The following materials are used to meet the Basic Graphics module objectives in Volume i (p. 27).

Objectives	Resources
1-11	General Source: Architecture Drafting Design, 2nd ed., Helper and Wallach, McGraw-Hill Pub.
1	Audio/Visual aids, instructor.
2	General Source, pp. 170-72, 210, 407-8, 421.
3	General Source, p. 127 Drafting Kits, graph paper, drawing paper, vellum, print paper, blueprint machine.
4	General Source, pp. 193-4, 266.
5	General Source, pp. 175, 204. Instructor generated exercise, Resource A.
6	Heat Loss Calculation form: Modine Manufacturing Co., 1500 Dekoven Ave., Racine, WI 53401, Heating and Air Conditioning Division.
7	General Source, pp. 170-3, 210, 407-8, 421.
8	General Source, pp. 209, 282-3.
9	General Source, p. 181.
10	General Source p. 150.
11	Drawings and blueprints of IUSB Buildings.
Evaluation	Examinations, ongoing observations and critique of students' work Resources B and C.


63'
WING RM.
12'x19'
DINING
12'x13'
KITCHEN
8'x12'
FAMILY RM.
12'x19'
GARAGE
18'x22'
3'x7'
3'x6'
3'x8'
FOYER
BATH
5'x8'
BATH
7'x8'
CL.
BEDROOM
10'x11'
3'x5'
CL.
BEDROOM
12'x14'
BEDROOM
11'x13'
NORTH
DRIVEWAY

DO THE FOLLOWING –

1. DETERMINE OVERALL DIMENSIONS NORTH TO SOUTH & EAST TO WEST.
2. MAKE A SKETCH OF ONE-LINE FLOOR PLAN ABOVE SO IT IS CENTERED ON YOUR PAPER.
3. MAKE A QUICK CACULATION OF SQUARE FOOTAGE. (MINUS GARAGE)
4. DO A REVERSE PLAN.


34'-0"
5'-8"
7'-6"
6'-3"
12'-6"
2'-6"
3'-3"
26'-6"
17'-6"
5'-9"
A
B
C
D
E
F
G
H

FLOOR PLAN

SCALE: 1/8" = 1'-0"

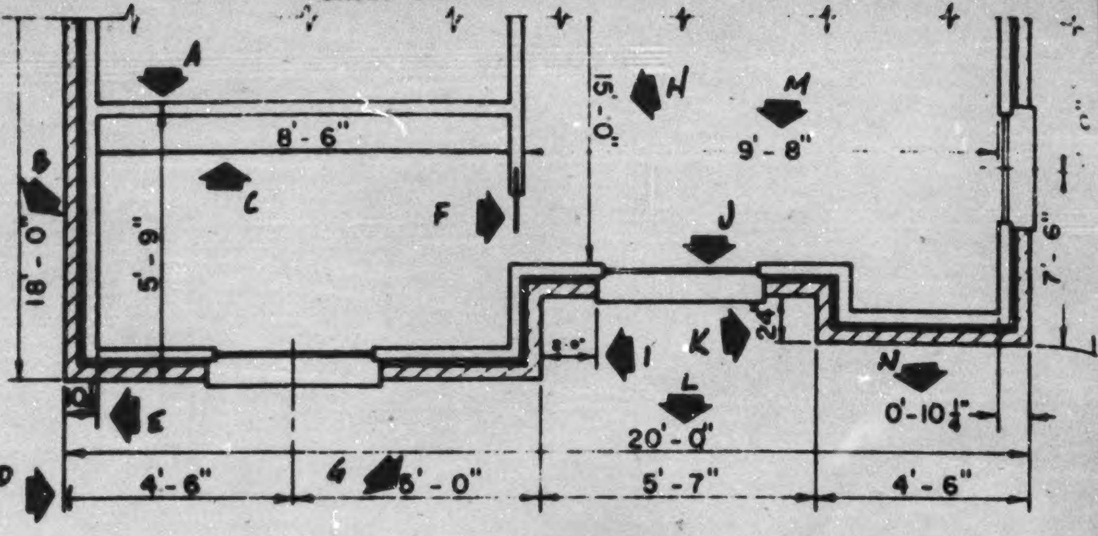
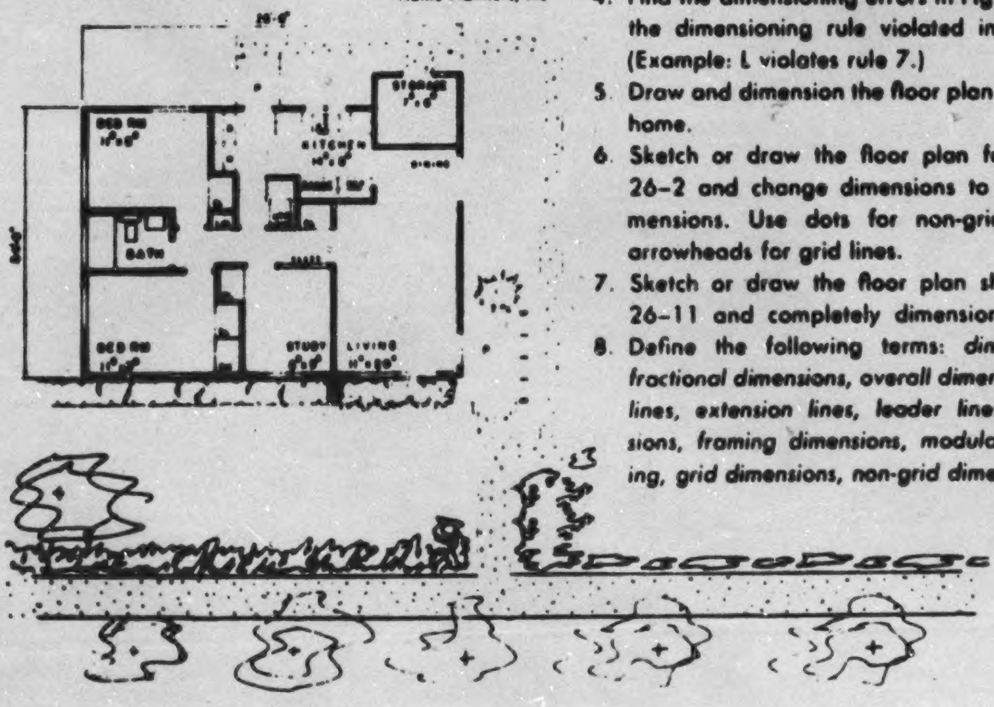

A
B
C
D
E
F
G
H
I
J
K
L
M
N
8'-6"
5'-9"
18'-0"
15'-0"
9'-8"
7'-6"
2'-0"
24
10
20'-0"
0'-10¼"
4'-6"
6'-0"
5'-7"
4'-6"

Fig. 26–10. Find the dimensioning errors shown by the letters.

Fig. 26–11. Draw a floor plan of this house complete with dimensions.

Home Planners, Inc


STORAGE
KITCHEN
BED RM
BATH
BED RM
STUDY
LIVING

3. Dimension the floor plan shown in Fig. 26- by the modular method.
4. Find the dimensioning errors in Fig. 26–10. Li the dimensioning rule violated in each cas (Example: L violates rule 7.)
5. Draw and dimension the floor plan of your ow home.
6. Sketch or draw the floor plan found in Fig 26–2 and change dimensions to modular d mensions. Use dots for non-grid lines an arrowheads for grid lines.
7. Sketch or draw the floor plan shown in Fig 26–11 and completely dimension your pla
8. Define the following terms: *dimension lin fractional dimensions, overall dimensions, cente lines, extension lines, leader lines, subdime sions, framing dimensions, modular dimensio ing, grid dimensions, non-grid dimensions.*

BLUEPRINT READING

The following materials are used to meet the Blueprint Reading module objectives in Volume i (p. 33).

Objective	Resource
1	See objective 2 resources for Basic Graphics.
2	See objectives 1, 4, 5 and 9 resources for Basic Graphics.
3	Blueprints of Northside Hall, University Center and Administration Building, IUSB. Class discussion and explanations from instructor.
Evaluation	Symbol recognition exam Oral testing on blueprints and explanation of components by student to instructor.

BUILDING CODES AND ENGINEERING GUIDELINES

The following materials are used to meet the Building Codes and Engineering Guidelines module objectives in Volume i (page 36).

Objective	Resource
1	Introductory lecture by city building inspectors using various pertinent code books.
1	"Basic Requirements for Building Code", prepared by Joseph Weiler, chairman, for the Building Code Advisory Review Board, Department of Industry, Labor and Human Relations, State of Wisconsin, Madison, Wisconsin, January 12, 1968.
1	ASHRAE 90-75
1	Indiana Uniform Building Code (6 volumes).
2	"Building Materials", Handyman, Bariner Press, New York, New York, pages 99-116.
3	American National Standard Safety requirements for industrial head protection, Z89.1-1969.
3	OSHA Handbook for Small Businesses, OSHA, 2209, 1977.
Evaluation	Exam -Resource A

Occupational Safety and Health
Final Examination

Date: __________

Student's Name: ________________________

QUESTIONS

1. Name three (3) major parts of a stepladder.

   1. __________; 2. __________; 3. __________.

2. For reasons of safety, one should not step on two parts of a stepladder. One of these parts is the top step; what is the name of the other part?

   ____.

3. The stepladder has two parts which hold the ladder open; what is the name of these parts? ____.

4. Before mounting a stepladder, should the parts mentioned in question #2 be (circle the correct answer)?

   1. Unlocked; 2. locked; 3. One locked & the other unlocked.

5. Of the three grades of ladders, which one would you probably use in your work (circle your choice)?

   1. Household; 2. Commercial; 3. Industrial

6. Touching an electric wire with a metal ladder may cause (circle the best answer):

   1. A shock;
   2. A burn;
   3. Death;
   4. A blown fuse;
   5. None of these four events;
   6. All of these four events.

7. When stepping from a ladder to a roof or other structure, how far past the upper ladder support point should the ladder extend? (Supply the missing number.)

   The ladder should extend a minimum of ________ feet past the support.

8. How far from the wall should the foot of a ladder be placed if the ladder touches the wall at a height of 12 ft.? (Supply the missing number.)

   The foot of the ladder should be _____ feet from the wall.

9. You may encounter three general types of respiratory hazards in your work. One of these hazards is bacteria. Name two others:

1. ______________________; 2. ________________.

10. Good protection against these respiratory hazards is the use of a good ____________________ mask.

11. A good dust mask will: (circle the best answer(s).)

1. Be blue or green in color;
2. Fit well at the edges;
3. Be comfortable;
4. Come in a cardboard box.

12. One eye hazard you may encounter is projecting nails or wire. Name another eye hazard which is common to your work.

A. ___________________________.

13. The best all-around eye protection for an energy auditor is probably a pair of ____________________________.

14. Name one of the most common head hazards you will probably encounter in your work.

A. ___________________________.

15. What is the best protection against the type of hazard mentioned in question #14.

A. ______________________________.

16. In addition to knee pads, name another aid to safety you might use.

A. ______________________________.

17. Name a medical precaution you might take before you start work as a protection against tetanus.

A. ________________________________.

18. Name a hazard which you might face when working in an unfloored attic.

A. __________________________________.

19. When working in crawl spaces, one of the hazards you might face is broken glass and old nails. Name another hazard you might encounter in crawl spaces.

A. ________________________________.

20. In addition to head, eye, and respiratory protection devices, name another personal protection item.

A. _____________________________.

ELECTRICITY

The following materials are used to meet the Electricity module objective in Volume i (p. 39).

Objective	Resource
1	*Understanding and Using Electricity*, McKenzie and Zachariah, Interstate Printers, Danville, IL, Units 1, 2, & 7: Demonstrate use of Voltammeters and watt-hour meters.
1	Student-generated "Glossary of Electrical Terms" Resource A
2	Electricity and Wiring, *Handyman*, Bariner Press, New York, NY pp. 389-420: Uniform Electrical Code.
2	Examine electrical controls: handout on wire dimensions Resource B: Handout on current electrical rates for locale.
3	Examine various types of motors.
Evaluation	Instructor's quizzes Resources C-G
Evaluation	Instructor's exam Resource H

PROJECT EFFECT
IUSB
GLOSSARY OF ELECTRICAL TERMS

1.	Alternating Current	- an electric current that reverses its direction at regularly recurring intervals -- abbr. AC. Or, a periodic current which has alternately positive and negative values.
2.	Ambient Temperature	- the temperature of the surrounding medium, such as gas or liquid, which comes into contact with the parts of the apparatus.
3.	Ammeter	- an instrument for measuring electric current in amperes.
4.	Ampere	- the practical mks (abbr. meter-kilogram-second) unit of electric current that is equivalent to a flow of one coulomb per second, or to the steady current produced by one volt applied across a resistance of one ohm. If the scale is graduated in milliamperes or microamperes, the instrument is usually designated as a milliammeter or a microammeter.
5.	Ampere Hour	- the quantity of electricity passing in one hour through a circuit in which the steady, or effective, value of the current is one ampere.
6.	Balanced Circuit	- a circuit in which there are substantially equal currents, either alternating or direct, in all main or phase wires and substantially equal voltages between main or phase wires and between each main or phase wire and neutral (if one exists).
7.	Bridge Circuit	- a network which is so arranged that, when an electromotive force is present in one branch, the response of a suitable detecting device in another branch may be made zero by a suitable adjustment of the electrical constants of still other branches; and which is characterized by the fact that if the electromotive force and the detecting device are interchanged, after completing an adjustment, the response of the detecting device is still zero.
8.	Capacitance	- that property of a system of conductors and dielectrics which permits the storage of electricity when potential differences exist between the conductors. Its value is expressed at the ratio of a quantity of electricity to a potential difference. A CAPACITANCE VALUE IS ALWAYS POSITIVE.
9.	Capacitor (condenser)	- a device, the primary purpose of which is to introduce capacitance into an electric circuit.
10.	Cell, Standard	- a cell which serves as a standard of electromotive force.
11.	Circuit, Electric	- a conducting part or a group of interconnected conductting parts capable of carrying electric current. Normally, it is the path or paths through which electric currents are intended to pass.

Glossary - Electrical Terms (Cont'd)

12. Circuit, Magnetic - a closed path of magnetic flux, the path having the direction of the magnetic induction at every point.

13. Circuit, Parallel, (Multiple) - a circuit consisting of two or more branch circuits connected to common terminal junction points.

14. Circuit, Series - a circuit in which two or more devices connected in series, i.e. so connected that the same curent passes through each device.

15. Circuit, Two - Phase - or quarter-phase circuit is a combination of circuits energized by alternating electromotive forces which differ in phase by a quarter of a cycle; i.e. 90 degrees. Note: In practice the phases may vary several degrees from the specified angle.

16. Circular Mil - the area of a circle whose diameter is one mil (1/1000 in.). A unit of area equal to: $\frac{Pi}{4}$ (=0.7854) of a square mil. The area of a circle in circular mils is, therefore, equal to the square of its diameter in mils.

17. Clockwise Motion - rotation in the same direction as that of the hands of a clock, front view.

18. Commutator - a switch for reversing the direction of an electric current.

19. Component - one of two or more forces which taken together would produce the same effect as a given force. The forces may be mechanical or electrical. One of two or more currents, voltages or fluxes which taken together would produce the same effect as a given current, voltage or flux.

20. Conductance - conducting power. The readiness with which a conductor transmits an electric current. The reciprocal of electric current.

21. Constant - a quantity used in an equation, the value of which remains the same, regardless of the values of other quantities used in the equation. Invariale or uniform.

22. Coulomb - the practical unit of the quantity of electricity. It is the quantity of electricity which passes any section of an electrical circuit in one second, when the current in the circuit is one ampere.

23. Counterclockwise Motion - rotation in a direction opposite to that of the hand of a clock, front view.

24. Current - the rate at which electricity flows or passes through a circuit.

25. Cycle - the complete series of values of a periodic quantity which occur during a period.

26. Demand - the load which is drawn from the source of supply at the receiving terminals averaged over a suitable and specified interval of time. Demand is expressed in kilowatts, kilovolt-amperes, amperes, kilovars or other suitable units.

Glossary - Electrical Terms (Cont'd)

27.	Direct Current	- an electric current flowing in one direction only and substantially constant in value. -- abbr. DC. NOTE: THAT WHICH IS FOUND OR UTILIZED IN A BATTERY.
28.	Eddy Currents (Foucault Currents)	- those currents which are induced in the body of a conducting mass by a variation of magnetic flux. These currents occur whenever alternating currents flow through conductors.
29.	Effective Resistance	- a resistance to a periodic current. Is equal to watts divided by the square of the effective value of current.
30.	Effective Value (Root-Mean-Square Value)	- the value normally indicated by alternating current instruments.
31.	Electrical Degree	- the 360th part of one complete alternating current cycle.
32.	Electrical Meter	- a device or instrument that registers and measures an amount of electrical quantity with respect to time.
33.	Electrostatic Voltmeter	- an instrument provided with a scale, usually graduated in volts or kilovolts.
34.	Electrothermic Instrument	- an instrument which depends for its oepration on the heating effect of a current. Two distinct types - (a) the expansion type, including the "hot-wire" and "hot-strip" instruments, and (b) the thermocouple type.
35.	Faraday's Law of Induction	- two circuits coupled together by the effects of Faraday induction. While the current in circuit 1 is changing, an emf (Electromotive Force) is induced in circuit 2.
36.	Galvanometer	- an instrument for indicating or measuring a small amount of electric current.
37.	Gauss	- a unit of magnetic flux density.
38.	Gilbert	- a unit of magnetomotive force.
39.	Gradient	- the rate of change (increase or decrease) of voltage or other quantity with respect to distance.
40.	Gram	- a unit of mass in the metric system.
41.	Ground	- a conducting connection, whether intentional or not, between an electric circuit or equipment and earth, or to some conducting body which serves in place of earth. An object that makes an electrical connection with the earth.
42.	Horological Standards	- standards for the measurement of time.

Glossary - Electrical Terms (cont'd)

43. Horsepower - a commercial unit of power equal to the average rate of doing work when 33,000 pounds is raised one foot in one minute. To convert to practicality - equal to 746 WATTS.

44. Hot-Wire Instrument - an electrothermic instrument which depends for its operation on the expansion by heat of a wire carrying a current. The "Hot-strip" instrument differs from the hot-wire instrument only in having a metallic strip in place of a wire.

45. Induced Current - to produce (as an electric current) by induction.

46. Inductance - a property of an electric circuit by which an electromotive force is induced in it by a variation of current either, (1) in the circuit itself or (2) in a neighboring circuit.

47. Joule - the practical unit of electrical energy equal to a watt-second.

48. Joule's Law - the rate at which heat is produced in an electric circuit of constant resistance is proportional to the square of the current.

49. Kilo - a prefix meaning one thousand of a specified unit, (kilovolt, kilowatt).

50. Lines of Force - imaginary lines within a magnetic or electrostatic field which indicate by their direction the direction of magnetic or electrostatic force at each point. By convention it is considered that the number of such lines per unit area (taken at right angles to lines of force) is a measure of the strength of the field.

51. Loading transformer - a transformer of low secondary voltage, usually provided with means for obtaining various definite values of current, whereby the current circuit of the device under test and of the test standard can be energized.

52. Magnet - a body which produces a magnetic field external to itself.

53. Magnet Coil - a coil of insulated wire by which the magnetizing current is carried around the core of an electromagnet.

54. Magnetic Pole - those portions of the magnet toward which the external magnetizing force tends to converge or diverge.

55. Mega - a prefix meaning one million of a specified unit (megawatt, megohm).

56. Meter, Excess - an excess meter is a meter that records either exclusively or separately that portion of the energy consumption taken at a demand in excess of a predetermined demand.

57. Mil - a unit of length equal to one one-thousandth of an inch.

58. Milli - a prefix meaning one thousandth part of a specified unit, i.e. (milliampere, millihenry, millivolt).

59. OHM (THE MOST IMPORTANT LAW IN ELECTRICITY)- The practical unit of electrical resistance. It is the resistance which allows one ampere to flow when the impressed potential is one volt.

60. OHM's Law - a unit of electrical resistance equal to that of a conductor in which a current of one ampere is produced by a potential of one volt across its terminals. (German Physicist, 1787-1854 (67 years length of life).
Formula: V= IR V equals Voltage I equals Current
R equals Resistance
Voltage equals Current X Resistance.
Power = IV= 1^2 . R.

61. Oscillograph - an instrument for producing a record of the instantaneous values of one or more rapidly varying electrical quantities as a function of time or of an other electrical or mechanical quantity.

62. Percentage Error - the difference between its percentage registration and one hundred per cent (100%).

63. Period - the period of an alternating current is the time required for the current to pass through one cycle.

64. Phase Angle - the phase angle or phase difference between a sine voltage and a sine current is defined as the number of electrical degrees between the beginning of the cycle of voltage and the beginning of the cycle of current.

65. Polarity - that of a battery, or transformer, is the designation of the direction in which instantaneous current tends to flow.

66. POTENTIAL Difference - measured by the work required to transfer a unit quantity of positive electricity from the point of lower potential to the point of higher potential.

67. Power - the rate at which energy is transferred or transformed.

68. Pulsating Current - a periodic current, the values of which ARE ALWAYS POSITIVE, (OR ALWAYS NEGATIVE).

69. Rating - of a machine, apparatus or device is a designated limit of operating characteristics based on definite conditions. NOTE: Such operating characteristics as load, volt age, frequency, etc., may be given in the rating.

70. Reactance - the part of the impedance of an alternating-current circuit that is due to capacitance or inductance or both, and that is expressed in ohms.

71. Reluctance - the reciprocal of permeance. PERMEATION, OR the act of spreading or diffusing.

72. Resistor - a device, the primary purpose of which is to introduce resistance into an electric curcuit.

Glossary - Electrical Terms (Cont'd)

73. Rheostat - an adjustable resistor so constructed that its resistance may be changed without opening the circuit in which it may be connected.

74. Secondary Winding - on a transformer is the winding on the output side which receives power from the primary winding by INDUCTION.

75. Solenoid - an electromagnet having an energizing coil approximately cylindrical in form and operating on a movalbe core or plunger.

76. Thermocouple - a pair of dissimilar conductors so joined that an electromotive force is developed by the thermoelectric effect when the two junctions are at different temperatures.

77. Transformer - an electrical device, without continuously moving parts which by electromagnetic induction transforms electric energy from one or more circuits to one or more other circuits at the same frequency, usually with change values of voltage and current.

78. Var - the unit of reactive power. abbr. (1) visual-aural range. (2) volt-ampere reactive.

79. Varhour - the unit for expressing the intergral of reactive power in vars over an interval of time expressed in hours.

80. Volt - the practical unit of electromotive force. ONE VOLT WILL PRODUCT A CURRENT OF ONE AMPERE THROUGH A RESISTANCE OF ONE OHM.

81. Watt - the practical unit of active power and is defined as the rate at which energy is delivered to a circuit.

82. Watthour - unit of electrical energy which is expended or transformed in one hour when the power is one watt.

83. Wattmeter - an instrument for measuring the magnitude of the active power in an electric circuit. Such meter is provided with a scale, usually graduated in either watts, kilowatts, or megawatts.

84. Wave Form or Shape - the wave form of an alternating voltage or current is the shape of a curve plotted to represent the variation of the voltage or current with respect to time. The sine wave form is the standard of reference. When the wave froms are not the same, the power factor of the circuit will be less than unity, even when the voltage and the current reverse at the same instant.

85. Wheatstone Bridge - a device for measuring electrical resistance, (d-c).

REFERENCES AND/OR SOURCES:

1. "Fundamentals of Electricity and Magnetism", Second Edition, 1962 and 1969 by McGraw-Hill, Inc. Author: Arthur F. Kip, Professor of Physics, University of California at Berkeley.
2. Webster's New Collegiate Dictionary, Copyright 1977 by G. & C. Merriam Co.
3. "ELECTRICAL METERMEN'S HANDBOOK 1950 Ed.

DIMENSIONS OF WIRE (Continued)

British Standard Gauge

Giving the diameter and cross-section in English and metric system for the British Standard Gauge.

Gauge No.	Diameter in in.	Section in sq. in.	Diameter in cm	Section in sq. cm
0000000	0.500	0.1963	1.2700	1.267
000000	.464	.1691	1.1786	1.091
00000	0.432	0.1466	1.0973	0.9456
0000	.400	.1257	1.0160	.8107
000	.372	.1087	0.9449	.7012
00	.348	.0951	.8839	.6136
0	0.324	0.0825	0.8230	0.5319
1	.300	.07069	.7620	.4560
2	.276	.05983	.7010	.3858
3	.252	.04988	.6401	.3218
4	.232	.04227	.5893	.2727
5	0.212	0.03530	0.5385	0.2277
6	.192	.02895	.4877	.18679
7	.176	.02433	.4470	.15696
8	.160	.02010	.4064	.12973
9	.144	.01629	.3658	.10507
10	0.128	0.01287	0.3251	0.08302
11	.116	.010568	.2946	.06818
12	.104	.008495	.2642	.05480
13	.092	.006648	.2337	.04289
14	.080	.005027	.2032	.03243
15	0.072	0.004071	0.1829	0.02627
16	.064	.003217	.16256	.020755
17	.056	.002463	.14224	.015890
18	.048	.001810	.12192	.011675
19	.040	.001257	.10160	.008107
20	0.036	0.001018	0.09144	0.006567
21	.032	.0008042	.08128	.005189
22	.028	.0006158	.07112	.003973
23	.024	.0004524	.06096	.002922
24	.022	.0003801	.05588	.002452
25	0.020	0.0003142	0.05080	0.002027
26	.0180	.0002545	.04572	.0016417
27	.0164	.0002112	.04166	.0013628
28	.0148	.0001720	.03759	.0011099
29	.0136	.0001453	.03454	.0009383
30	0.0124	0.0001208	0.03150	0.0007791
31	.0116	.00010568	.02946	.0006818
32	.0108	.00009161	.02743	.0005910
33	.0100	.00007854	.02540	.0005067
34	.0092	.00006648	.02337	.0004289
35	0.0084	0.00005542	0.02134	0.0003575
36	.0076	.00004536	.01930	.0002927
37	.0068	.00003632	.01727	.0002343
38	.0060	.00002827	.01524	.0001824
39	.0052	.00002124	.01321	.0001370
40	0.0048	0.00001810	0.01219	0.0001167
41	.0044	.00001521	.01118	.0000982
42	.0040	.00001257	.01016	.0000811
43	.0036	.00001018	.00914	.0000656
44	.0032	.00000804	.00813	.0000519
45	0.0028	0.00000616	0.00711	0.0000397
46	.0024	.00000452	.00610	.0000292
47	.0020	.00000314	.00508	.0000203
48	.0016	.00000201	.00406	.0000129
49	.0012	.00000113	.00305	.0000073
50	0.0010	0.00000079	0.00254	0.0000051

PLATINUM WIRE

Mass in Grams per Foot

B. & S. Gauge	Diameter, inches	Mass, g per ft.	B. & S. Gauge	Diameter, inches	Mass, g per ft.
10	.1019	37.5	23	.02257	1.8
11	.09074	28.0	24	.02010	1.4
12	.08081	22.0	25	.01790	1.1
13	.07196	17.5	26	.01594	0.9
14	.06408	14.0	27	.01420	0.7
15	.05707	11.0	28	.01264	0.6
16	.05082	9.0	29	.01126	0.45
17	.04526	7.0	30	.01003	0.35
18	.04030	5.7	31	.008928	0.28
19	.03589	4.4	32	.007950	0.22
20	.03196	3.4	33	.007080	0.17
21	.02846	2.9	34	.006305	0.15
22	.02535	2.3	35	.005615	0.11

ALLOWABLE CARRYING CAPACITIES OF CONDUCTORS

(National Electrical Code)

The ratings in the following tabulation are those permitted by the National Electrical Code for flexible cords and for interior wiring of houses, hotels, office buildings, industrial plants, and other buildings.

The values are for copper wire. For aluminum wire the allowable carrying capacities shall be taken as 84% of those given in the table for the respective sizes of copper wire with the same kind of covering.

Size A.W.G.	Area Circular Mils	Diameter of Solid Wires Mils	Rubber Insulation Amperes	Varnished Cambric Insulation Amperes	Other Insulations and Bare Conductors Amperes
18	1,624.	40.3	3*	...	6†
16	2,583.	50.8	6*	...	10†
14	4,107.	64.1	15	18	20
12	6,530.	80.8	20	25	30
10	10,380.	101.9	25	30	35
8	16,510.	128.5	35	40	50
6	26,250.	162.0	50	60	70
5	33,100.	181.9	55	65	80
4	41,740.	204.3	70	85	90
3	52,630.	229.4	80	95	100
2	66,370.	257.6	90	110	125
1	83,690.	289.3	100	120	150
0	105,500.	325.0	125	150	200
00	133,100.	364.8	150	180	225
000	167,800.	409.6	175	210	275
0000	211,600.	460	225	270	325

1 Mil = 0.001 inch.

* The allowable carrying capacities of No. 18 and 16 are 5 and 7 amperes respectively, when in flexible cords.

† The allowable carrying capacities of No. 18 and 16 are 10 and 15 amperes respectively, when in cords for portable heaters. Types AFS, AFSJ, HC, HPD, and HSJ.

RESOURCE B

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PROJECT EFFECT - IUSB

Electricity

QUIZ #1

1. A circuit consists of a voltage source, V, connected to a resistor. If voltage is doubled,

    a. the resistance doubles
    b. the resistivity doubles
    c. the current doubles
    d. the current is cut in half

2. The units of resistance are:

    a. coulombs
    b. charge
    c. amperes
    d. ohms

PROJECT EFFECT - IUSB

Electricity

QUIZ #2

Circle the best answer

1. A toaster uses 5 amps at 120 v. This means the toaster uses

    a. 120 watts
    b. 5 watts
    c. 24 watts
    d. 600 watts

2. A fuse is placed in a circuit so that

    a. the wires do not overheat
    b. the chance of an electrical fire is reduced
    c. to limit the current in the circuit
    d. all of the above

RESOURCE D

PROJECT EFFECT - IUSB

Electricity

QUIZ #2

Circle the best answer

1. A toaster uses 5 amps at 120 v. This means the toaster uses
   - a. 120 watts
   - b. 5 watts
   - c. 24 watts
   - d. 600 watts

2. A fuse is placed in a circuit so that
   - a. the wires do not overheat
   - b. the chance of an electrical fire is reduced
   - c. to limit the current in the circuit
   - d. all of the above

PROJECT EFFECT - IUSB

Electricity

QUIZ #3

Circle the best answer to the following:

1. The energy used in an electrical appliance is

   a. the rating in volts times the rating in amps
   b. the rating in amps times the time the appliance is on
   c. the rating in watts times the time the appliance is on
   d. the rating in volts times the rating in watts

2. At 5¢ per kilowatt-hour, how much does it cost to leave a 100 watt, 120 volt light bulb on for 10 hours?

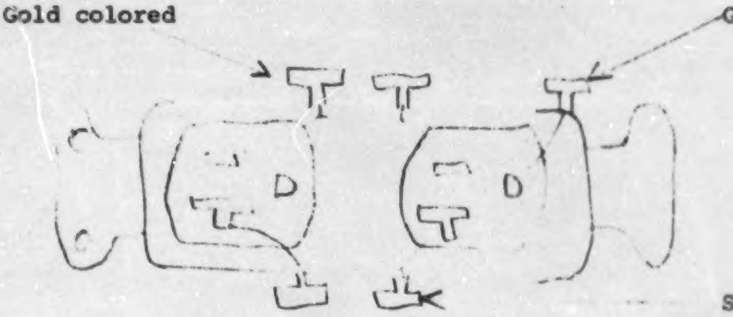
   a. 5¢
   b. 60¢
   c. 1/2¢
   d. 6¢

PROJECT EFFECT - IUSB

Electricity

QUIZ #4

A cable with three #12 wires comes from a fuse box to an outlet. One wire has black insulation, another has white insulation, and the third has no insulation. These wires are to be connected to the terminals of the outlet. Refer to the outlet diagram below:



a. The hot lead (wire) has ______________ insulation.

b. The neutral lead has ______________ insulation.

c. The ground lead has ______________ insulation.

d. The green screw is attached to the ______________ lead.

e. The gold screw is attached to the ______________ lead.

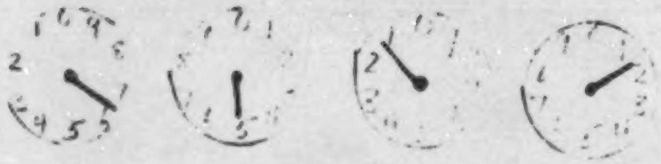
f. The silver screw is attached to the ______________ lead.

PROJECT EFFECT - IUSB

Electricity

QUIZ #5

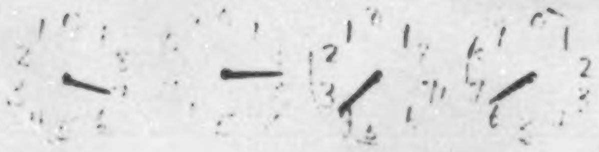
1.



The watt-hour meter readings are:

________ ________ ________ ________

2.



________ ________ ________ ________

ELECTRICITY AND ELECTRIC CODE MODULE
1978 Test

I. Connect by a line the best answers from the second column with the items listed in the first column.

1. Current
2. Voltage
3. Watt
4. D.C.
5. Ohm
6. Fuse
7. Thermocouple
8. Kilowatthour
9. A.C.
10. Conduit

A. Current flowing in one direction

B. Electrical pressure

C. Converts a change in temperature into voltage

D. Flows from (+) to (-).

E. Electrical power unit

F. Alternating current

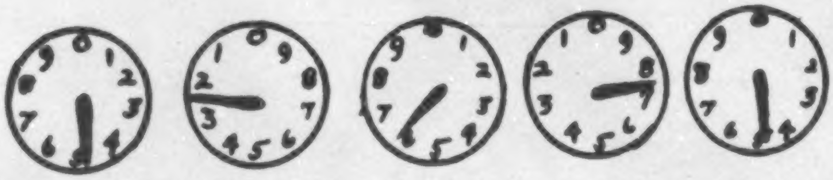
G. Metal tube for wires

H. Electric safety switch

I. Electrical energy unit

J. Resistance unit

II.

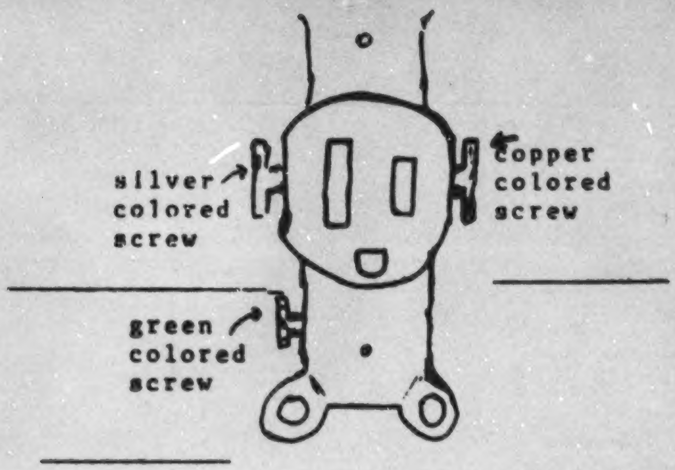


If this was a pointer registed kilowatt-meter, what is this reading?

_____ _____ _____ _____ _____ kilowatt-hours

III. In nonmetalic sheathed NM 14/2 with ground, the copper wires are colored white and black and the third wire is bare. If used in a branch circuit, which wire is connected to the hot side ____________________, neutral ____________________, and ground____________________? The circuit wire is AWG (American Wire Guage) size ____________________ and with thermoplastic insulation type TW the maximum current allowed, and therefore if fuse or circuit breaker size, is ____________________ amperes.

IV. For the simplex outlet shown at the right, label the hot side, neutral side, and ground.



V. For each of the following, mark T for true, F for false.

___ 1. Materials made up of atoms with electrons tightly bound are called insulators.

___ 2. Copper is a good conductor

___ 3. If a wire loop is placed in a magnetic field, a constant D.C. current flows in the wire.

___ 4. A rotating loop of wire placed in a magnetic field may be used to generate an A.C. voltage.

___ 5. Transformers are used to lower voltages in A.C. circuits.

___ 6. Transformers are also used to raise voltages in A.C. circuits.

___ 7. The smaller the AWG number for a wire, the smaller the wire diameter.

___ 8. All wire splices and joints must be located in electrical junction boxes.

___ 9. It is accepted practice to place all kitchen appliances on the same branch circuit.

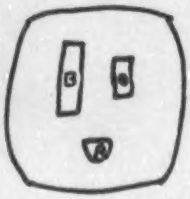
___10. A "ground fault interupter" is a fuse in the ground wire of a circuit.

VI. What will be the correct voltage between the indicated terminals of a correctly wired outlet.

1. A→B voltage ________ volts.

2. A→C voltage ________ volts.

3. B→C voltage ________ volts.



VII. Why should time delay or slo-blo fuses or circuit breakers be used in motor circuits instead of regular fuses?

INTRODUCTION TO COOLING SYSTEMS

The following materials are used to meet the Introduction to Cooling Systems module objectives in Volume i (p. 42).

Objective	Resource
1 & 2	Understanding and Using Electricity, McKenzie and Zachariah, Interstate Printers, Danville IL, pp.76-80.
2	Performance chart on Freon-12 Resource A
3	Terminology, 1972 ASHRAE Handbook of Fundamentals, Chapter 1.
3	Handout on Equivalent Temperature Differences, Sensible Cooling Load, and Shade Line Factors Resources B & C.
4	12-step estimating procedure for calculating Design Cooling Loads Resource D.
5	Climatological data from weather bureau.
6	Understanding and Using Electricity pp. 76-80 Definitions of COP and EER Resource E.
Evaluation	Instructor's exam Resource F.

RESOURCE A

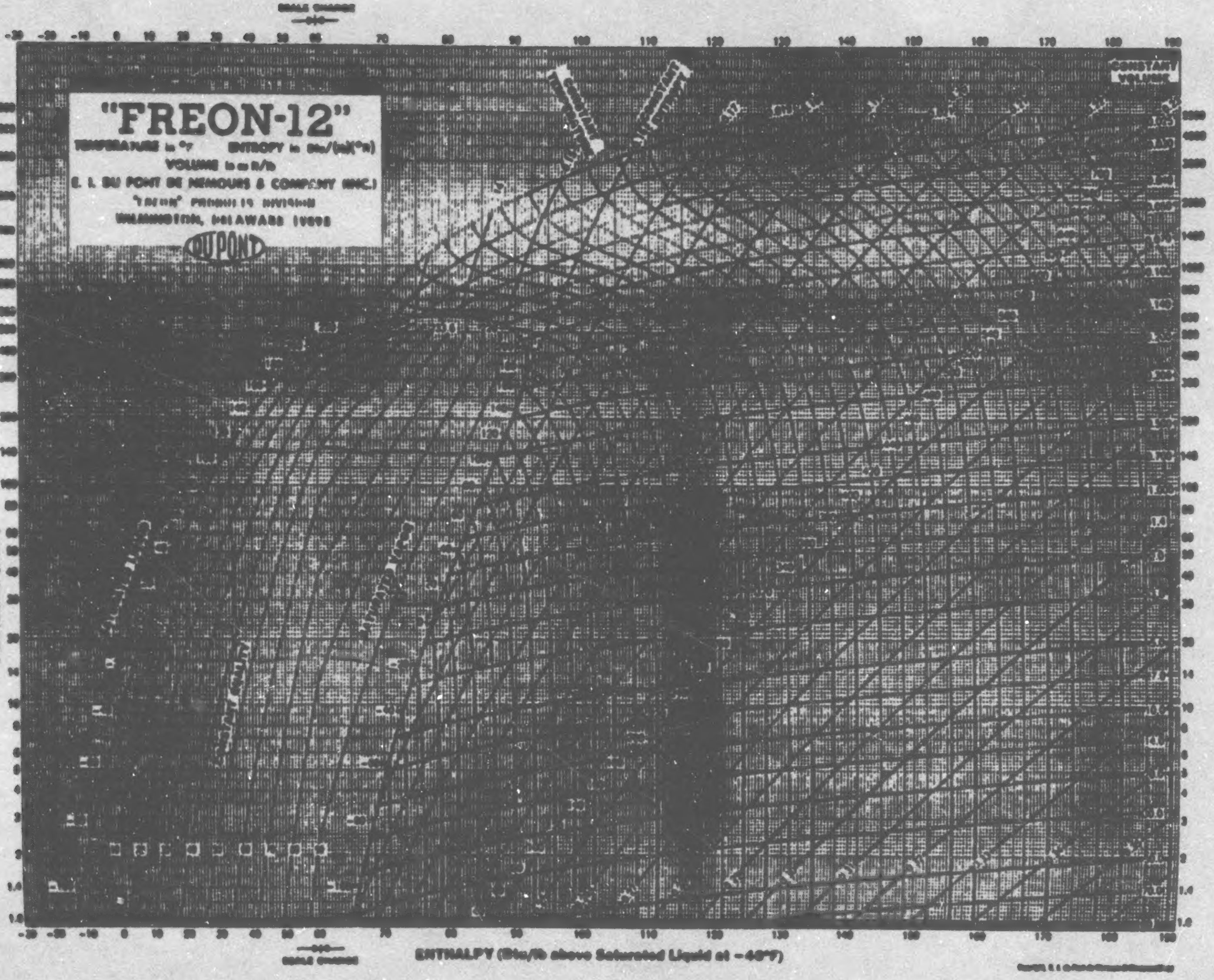


Fig. 9-6. Pressure-enthalpy diagram for refrigerant R-12. Note that 0 of enthalpy scale is taken at -40 F (-40 C).

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Table 34 .... Equivalent Temperature Differences

Design Temperature, F	85		90			95			100		105	110
Daily Temperature Range[a]	L	M	L	M	H	L	M	H	M	H	H	H
WALLS AND DOORS												
1. Frame and veneer-on-frame	17.6	13.6	22.6	18.6	13.6	27.6	23.6	18.6	28.6	23.6	28.6	33.6
2. Masonry walls, 8-in. block or brick	10.3	6.3	15.3	11.3	6.3	20.3	16.3	11.3	21.3	16.3	21.3	26.3
3. Partitions, frame	9.0	5.0	14.0	10.0	5.0	19.0	15.0	10.0	20.0	15.0	20.0	25.0
masonry	2.5	0	7.5	3.5	0	12.5	8.5	3.5	13.5	8.5	13.5	18.5
4. Wood doors	17.6	13.6	22.6	18.6	13.6	27.6	23.6	18.6	28.6	23.6	28.6	33.6
CEILINGS AND ROOFS[b]												
1. Ceilings under naturally vented attic or vented flat roof—dark	38.0	34.0	43.0	39.0	34.0	48.0	44.0	39.0	49.0	44.0	49.0	54.0
—light	30.0	26.0	35.0	31.0	26.0	40.0	36.0	31.0	41.0	36.0	41.0	46.0
2. Built-up roof, no ceiling—dark	38.0	34.0	43.0	39.0	34.0	48.0	44.0	39.0	49.0	44.0	49.0	54.0
—light	30.0	26.0	35.0	31.0	26.0	40.0	36.0	31.0	41.0	36.0	41.0	46.0
3. Ceilings under unconditioned rooms	9.0	5.0	14.0	10.0	5.0	19.0	15.0	10.0	20.0	15.0	20.0	25.0
FLOORS												
1. Over unconditioned rooms	9.0	5.0	14.0	10.0	5.0	19.0	15.0	10.0	20.0	15.0	20.0	25.0
2. Over basement, enclosed crawl space or concrete slab on ground	0	0	0	0	0	0	0	0	0	0	0	0
3. Over open crawl space	9.0	5.0	14.0	10.0	5.0	19.0	15.0	10.0	20.0	15.0	20.0	25.0

[a] Daily Temperature Range
L (Low) Calculation Value: 12 Applicable Range: Less than 15 deg.
M (Medium) Calculation Value: 20 Applicable Range: 15 to 25 deg.
H (High) Calculation Value: 30 Applicable Range: More than 25 deg.

[b] Ceilings and Roofs: Factors for light-colored roofs calculated using procedure of footnote for Table 8. For roofs in shade, eight-hour average = 11 deg temperature differential. At 90 F design and medium daily range, equivalent temperature differential for light-colored roof equals 11 + (0.71)(39-11) = 31 deg.

All values for walls are based upon a *dark-wall* assumption. This is believed desirable since wall color is an unpredictable variable in any residence. Roof color is more likely to remain constant and can therefore be used as a design criterion.

Equivalent temperature differences for ceilings and roofs in Table 34 are not taken directly from averages of Table 8 values. Rather they are based upon sol-air temperatures compatible with measured *roof-surface* temperatures in the five research residences at the University of Illinois. As indicated in the footnote to Table 34, equivalent temperature differences for light-colored *roofs* are calculated using the Table 8 values for light-construction roofs in shade, and following the calculation procedure recommended in footnote 5 of Table 8. A proportionality factor, based upon residential research results, has been used.

Daily range (outdoor temperature swing on a design day) has significant effect upon equivalent temperature difference and hence upon the so-called thermal flywheel of the structure. Calculation and applicable range values are shown in Table 34 for daily temperature ranges classified as high, medium and low. Table 1 lists outdoor daily range for many cities. Others can be estimated by using regional geographical and weather pattern characteristics such as altitude, proximity to large bodies of water, prevailing winds, etc. Care should be exercised, however, since climatological characteristics change rapidly within a distance of a very few miles.

Sensible Heat Gain

Residential cooling load calculation procedures are almost invariably a sensible heat gain calculation. Because of the nature of the structure, the occupancy, and the equipment, the sensible heat is related to total heat by a proportionality factor of 1.3. Latent heat may or may not be identified separately.

Heat Gain Through Structural Components

The sensible heat gains through walls, floors, and ceiling areas of each room are calculated using the equivalent temperature differences of Table 34 and the coefficients of thermal conductivity for summer. For ceilings under naturally vented attics, or ceilings beneath vented flat roofs, use the combined *U* value for the roof, vented space, and ceiling. Where the design temperature difference (outdoor design temperature minus 75) is not an even increment of 5 deg, the equivalent temperature difference should be corrected by 1 deg for each degree difference from tabulated values.

Although a load calculation which considers the entire structure to be one area may, in some cases, be adequate for estimating purposes, the final equipment selection and system design should be based upon a room-by-room calculation. If this is not done, the designer has no basis for knowing how much conditioned air must be supplied to each room or area of the structure and no basis for designing the distribution system.

Heat Gains Through Windows

Heat flow through glass is discussed in detail earlier in this chapter. In residential installations, direct application of the design tables for flat glass (Tables 12 to 15 of Chapter 26 in the 1961 Guide And Data Book) has been found to result in unrealistically high calculated cooling loads. The data have therefore been interpreted in a manner similar to that used for equivalent temperature differences.[48] Window factors for residential cooling load calculation, tabulated in Table 35 have the following characteristics:

1. Different factors are presented for windows facing different directions.
2. The tabulated factors are averages of instantaneous heat gains for the hours of 5:30 a.m. to 6:30 p.m., and for 30 and 40 deg latitude.
3. The tabulated factors for directions of equal angle from south have been combined.
4. The tabulated factors are applicable for an indoor design temperature of 75 F and for outdoor design temperatures as indicated. (Interpolate to obtain factors for outdoor design temperatures other than those for which values are given.)
5. The tabulated factors incorporate consideration of rates of heat gain from sources shown in Tables 12 to 15 of Chapter 26 in the 1961 Guide And Data Book.
6. Effects of shading devices and different glass types are shown.

Table 35 .... Sensible Cooling Load Due to Transmitted and Absorbed Solar Energy and Air-to-Air Temperature Difference, Btuh per sq ft

Outdoor Design Temp.	Regular Single Glass						Regular Double Glass						Heat Absorbing Double Glass					
	85	90	95	100	105	110	85	90	95	100	105	110	85	90	95	100	105	110
No Awnings or Inside Shading																		
North	23	27	31	35	38	44	19	21	24	26	28	30	12	14	17	19	21	23
NE and NW	56	60	64	68	71	77	46	48	51	53	55	57	27	29	32	34	36	38
East and West	81	85	89	93	96	102	68	70	73	75	77	79	42	44	47	49	51	53
SE and SW	70	74	78	82	85	91	59	61	64	66	68	70	35	37	40	42	44	46
South	40	44	48	52	55	61	33	35	38	40	42	44	19	21	24	26	28	30
Draperies or Venetian Blinds																		
North	15	19	23	27	30	36	12	14	17	19	21	23	9	11	14	16	18	20
NE and NW	32	36	40	44	47	53	27	29	32	34	36	38	20	22	25	27	29	31
East and West	48	52	56	60	63	69	42	44	47	49	51	53	30	32	35	37	39	41
SE and SW	40	44	48	52	55	61	35	37	40	42	44	46	24	26	29	31	33	35
South	23	27	31	35	38	44	20	22	25	27	29	31	15	17	20	22	24	26
Roller Shades Half-Drawn																		
North	18	22	26	30	33	39	15	17	20	22	24	26	10	12	15	17	19	21
NE and NW	40	44	48	52	55	61	38	40	43	45	47	49	24	26	29	31	33	35
East and West	61	65	69	73	76	82	54	56	59	61	63	65	35	37	40	42	44	46
SE and SW	52	56	60	64	67	73	46	48	51	53	55	57	30	32	35	37	39	41
South	29	33	37	41	44	50	27	29	32	34	36	38	18	20	23	25	27	29
Awnings																		
North	20	24	28	32	35	41	13	15	18	20	22	24	10	12	15	17	19	21
NE and NW	21	25	29	33	36	42	14	16	19	21	23	25	11	13	16	18	20	22
East and West	22	26	30	34	37	43	14	16	19	21	23	25	12	14	17	19	21	23
SE and SW	21	25	29	33	36	42	14	16	19	21	23	25	11	13	16	18	20	22
South	21	24	28	32	35	41	13	15	18	20	22	24	11	13	16	18	20	22

These factors are the result of the same study[48] which resulted in suggesting modified equivalent temperature differences. Averaging in this manner was found to give results compatible with measured residential loads. Hence, these are averages only in the sense that combining numbers in this manner results in accurate factors for calculating window loads of residential structures.

In using these factors, the area of each window is multiplied by the appropriate glass factor. Factors incorporating shading devices, such as roller shades half drawn, have been developed in such a way that both the shaded and unshaded portions of a window are taken into account, and the entire window area should be used. When permanent shading devices over windows are used, their effects must be considered separately in determining the heat gain through windows. Glass protected by permanent shading, such as wide roof overhangs, is usually considered as being north-facing glass. Hence, the line of shadow from the overhang onto the window, the *shade line*, must be located.

Table 36 .... Shade Line Factors

Direction Window Faces	Latitude, Degrees						
	25	30	35	40	45	50	55
E	0.8	0.8	0.8	0.8	0.8	0.8	0.8
SE	1.9	1.6	1.4	1.3	1.1	1.0	0.9
S	10.1	5.4	3.6	2.6	2.0	1.7	1.4
SW	1.9	1.6	1.4	1.3	1.1	1.0	0.9
W	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Note: Distance shadow line falls below the edge of the overhang equals shade line factor multiplied by width of overhang. Values are averages for five hours of greatest solar intensity on August 1.

Shade line factors are given in Table 36. These factors are expressed as the distance the shade line falls beneath the edge of the overhang for each foot of overhang width. The tabulated values are the average of the shade line values for the 5 hr of maximum solar intensity on each wall orientation shown, and for a solar declination of 18 deg north (August 1). Northeast and northwest-facing windows are not effectively protected by roof overhangs, and in most cases no credit should be taken for shading of them.

Infiltration and Ventilation

Natural air leakage in residential structures is much smaller in summer than in winter. Winter air leakage in a specific structure is caused by two weather factors, the wind direction and velocity and the inside-outside temperature difference which causes the so-called chimney effect. This chimney effect is, of course, absent in summer, and wind velocities are lower in many localities.

Factors for calculating natural infiltration are shown in Table 37. These are based upon a leakage rate of one-half air

Table 37 .... Sensible Cooling Load Due to Infiltration and Ventilation

Design Temperature, F	85	90	95	100	105	110
Infiltration, Btuh per sq ft of gross exposed wall area	0.7	1.1	1.5	1.9	2.2	2.6
Mechanical Ventilation, Btuh per cfm	11.0	16.0	22.0	27.0	32.0	38.0

PROJECT EFFECT ENERGY AUDIT

Part 2 - Analysis of Existing Systems

COOLING LOAD STEP-BY-STEP

1. Determine design conditions:
   - a. Outdoor Dry Bulb Temperature
   - b. Outdoor Temperature Range - Low (L), Moderate (M), or High (H) - Table 34
   - c. Indoor Dry Bulb Temperature (usually 75°F)
   - d. Indoor Temperature "Swing" (usually 3°)
   - e. Equivalent Temperature Differences - Table 34
2. Determine and draw building elevations and plan view.
3. Identify and calculate "U" values for walls, doors, ceilings, floors, or any other structural components enclosing conditioned space ("building envelope").
4. Identify Glass Factors (Table 35 - F_G) and calculate heat gain for glass doors and windows in all directions with allowance for exterior shading (including roof overhangs, single or double glass, and interior shading devices (rollershades, draperies, etc.).
5. Determine areas and heat gain for:
   - a. Opaque walls (Net walls = Gross walls - Windows and doors).
   - b. Solid doors.
   - c. Ceilings and roof.
   - d. Basements (if necessary).
6. Infiltration - Gross Wall Area x Infiltration Factor (Table 37).
7. Mechanical Ventilation - Number of occupants x 10cfm/each x Ventilation factor (Table 37) (if provided).
8. Occupants - Number x 300 Btu/hr each.
9. Appliances - Add 1200 Btu/hr.
10. Ductwork - only if installed in unconditioned space.
11. Total heat gain sensible = [4.+5.+6.+7.+8.+9.+10]
12. Add 30% of 11. to account for latent (dehumidification) load to obtain total heat gain/cooling load (i.e. 12. = 1.3 x 11.).

PROJECT EFFECT
IUSB

COEFFICIENT OF PERFORMANCE

Coefficient of performance (COP) is the ratio of output.

In refrigeration work: the output is the amount of heat absorbed by the system; the input is the amount of energy required to produce this output.

For example, if one pint of refrigerant has an effective latent heat of 50 Btu, and the compressor pumping energy is equivalent to 10 Btu per pound, the coefficient of performance is 50 to ten or 5:1.

ENERGY EFFICIENCY RATIO

The energy efficiency ratio (EER) is the cooling done per hour in Btu's divided by the watts of electrical energy required to accomplish this cooling.

For example, looking at the name plate on a room air conditioner, you find that it is rated at a cooling capacity of 8,000 Btu/hour. The power requirements are 840 watts. The EER for this unit would be $\frac{8,000}{840}$ or 9.52 Btu per watt hour. The higher the EER, the more energy efficient the unit is.

COOLING

EXAM

1) If complete combustion requires 10 cubic feet of air to burn 1 cubic foot of gas to produce 1,000 Btu's of heat, how many cubic feet of air will be required to produce 5,000 Btu's of heat from any fuel.

Answer__________cubic feet

2) Using a sling psychrometer, we find in our room that the dry bulb (room) temperature is 80° and the wet bulb (saturated) temperature is 60°. Using the psychrometric chart, find the relative humidity in the room.

Answer__________%

3) If we brought saturated outside air at 40°F into the house and warmed it to 65°F without adding or removing moisture, what would be the relative humidity of the heated air?

Answer__________%

4) We find from a graph on R-22 refrigerant that the effective latent heat removal is 72 Btu per pound. The compressor work to remove this heat is 12 Btu's per pound. What is the COP (coefficient of performance) of this cooling cycle?

Answer__________

5) Reading the name plate data on a room air conditioner, we see that the unit~~s~~ is rated at 6,000 Btu per hour. The unit requires 700 watts. What is the EER (energy efficiency ratio) for this unit?

Answer__________

6) What are the four items of mechanical equipment required for a mechanical refrigeration system?

1)__________ 2)__________ 3)__________ 4)__________

7) What is the relative refrigeration (Effective Latent Heat) of R-12 refrigerant? Indicate source of your answer.

Answer__________ Btu's / pound Source__________

8) What is the boiling point at atmospheric pressure of R-12 refrigerant? Include source of your answer.

Answer__________ degrees F. Source__________

9) In a mechanical refrigeration system, is the evaporator on the high pressure side or the low pressure side of the system?

Answer__________

10) What four functions should an air conditioning system provide?

1)__________ 2)__________ 3)__________ 4)__________

COOLING EXAM

Answer Sheet

1) 50 cubic feet

2) 30 percent

3) 40 percent

4) 6

5) 8.57

6) 1) Compressor 2) Condenser 3) Expansion 4) Evaporation

7) 51.1 Btu's per pound Source: Electric Manual

8) 21.6 degrees F. Source: Electric Manual

9) Low side

10) 1) Temperture control 2) Humidity control 3) Filter 4) Air Movement

INTRODUCTION TO HEATING SYSTEMS

The following materials are used to meet the Introduction to Heating Systems module objectives in Volume i (p. 46).

Objective	Resource
1	Lectures plus materials on C, K, U, and R values, definitions of Degree Day and Design Temperature Difference, and R values for some common building materials Resource A.
2	Lecture material
3	Manual of Home Weatherizing, TVA Energy Conservation Material. Retrotech sections on heat loss, Retrotech Manual.
4	List of R values for some common building materials Resource B.
5	The Components of Comfort: Do You Remember Them? Resource C
5	Heating System checklist Resource D.
5	Chimneys and Draft Calculation and Fuels and Combustion, 1960 ASHRAE Guide and Data Book, chapters 36 & 33.
6	See Volume ii Energy Overview.
Evaluation	Exam Resource E.

k,-THERMAL CONDUCTIVITY: The amount of heat that passes through a homogenous material 1 inch thick and 1 square foot in area, in an hour's time, with a temperature difference of $1^{o}F$ between the two surfaces. Values of k are expressed in Btu's per hour (Btuh). The lower the k, the higher the insulating value.

C,-THERMAL CONDUCTANCE: Similar to conductivity but a measure of the rate of heat flow (Btu's) for the actual thickness of a material (either more or less than 1 inch) 1 square foot in area at a temperature difference of $1^{o}F$. The term usually is applied to homogenous materials, though it may be used with heterogeneous ones such as concrete block. If the k of a homogenous material is known, the C can be determined by dividing the k by the thickness. For example, a 3-inch thickness of a particular insulation with a "k" of 0.30, has a "C" of 0.10. The lower the "C," the higher the insulating value.

U,-OVERALL COEFFICIENT OF HEAT TRANSMISSION: The combined thermal value of all of the materials in a building section, air spaces, and surface air films. U is expressed in Btuh per square foot of area per ^{o}F temperature difference. The lower the U, the higher the insulating value.

R,-THERMAL RESISTANCE: A measure of ability to retard heat flow rather than ability to transmit heat. R is the numerical reciprocal of U, or C, thus $R = \frac{1}{U}$ or $\frac{1}{C}$. A wall with a U value of 0.07 has 14.3 units of resistance ($R = \frac{1}{U} = \frac{1}{0.07} = 14.3$). In this Manual, thermal

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resistance, R, is used in combination with numerals to designate thermal resistance values: R-11 equals 11 resistance units. The higher the R, the higher the insulating value. All insulation products having the same R, regardless of material and thickness, are equal in insulating value.

DESIGN TEMPERATURES. The exterior and interior temperatures selected as the basis for design.

"TD" (DESIGN TEMPERATURE DIFFERENCE). Difference between the interior and exterior design temperatures of a building.

DD-(DEGREE DAY): A degree day is a measure of heating requirements. Degree days are determined by subtracting a day's average temperature from a base of 65 degrees. If the average temperature for a day was 55 degrees, that day would have a degree day rating of 10.

RESISTANCE VALUES OF STRUCTURAL AND FINISH MATERIALS, INSULATIONS, AIR SPACES, AND SURFACE FILMS*

Wood bevel siding, 1/2 x 8, lapped	R-0.81
Wood siding shingles, 16", 7½" exposure	R-0.87
Asbestos-cement shingles	R-0.03
Stucco, per inch	R-0.20
Building paper	R-0.06
1/2" nail-base insulating board sheathing	R-1.14
1/2" insulating board sheathing, regular density	R-1.32
25/32" insulating board sheathing, regular density	R-2.04
1/4" plywood	R-0.31
3/8" plywood	R-0.47
1/2" plywood	R-0.62
5/8" plywood	R-0.78
1/4" hardboard	R-0.18
Softwood, per inch	R-1.25
Softwood board, 3/4" thick	R-0.94
Particle board (underlayment) 5/8"	R-0.84
Concrete blocks, two rectangular cores	
Sand and gravel aggregate, 8" thick	R-1.04
Cores filled with vermiculite	R-1.93
Lightweight aggregate, 8" thick	R-2.18
Common brick, per inch	R-0.20
Face brick, per inch	R-0.11
Sand-and-gravel concrete, per inch	R-0.08
Sand-and-gravel concrete, 8" thick	R-0.64
1/2" gypsumboard	R-0.45
5/8" gypsumboard	R-0.56
1/2" lightweight aggregate gypsum plaster	R-0.32
25/32" hardwood finish flooring	R-0.68
Asphalt, linoleum, vinyl, or rubber floor tile	R-0.05
Carpet and fibrous pad	R-2.08
Carpet and foam rubber pad	R-1.23
Asphalt roof shingles	R-0.44
Wood roof shingles	R-0.94
3/8" built-up roof	R-0.33
Air spaces (3/4")	
Heat flow UP	
Non-reflective	R-0.87
Reflective, one surface	R-2.23
Heat flow DOWN	
Non-reflective	R-1.02
Reflective, one surface	R-3.55
Heat flow HORIZONTAL	
Non-reflective (also same for 4" thickness)	R-1.01
Reflective, one surface	R-3.48

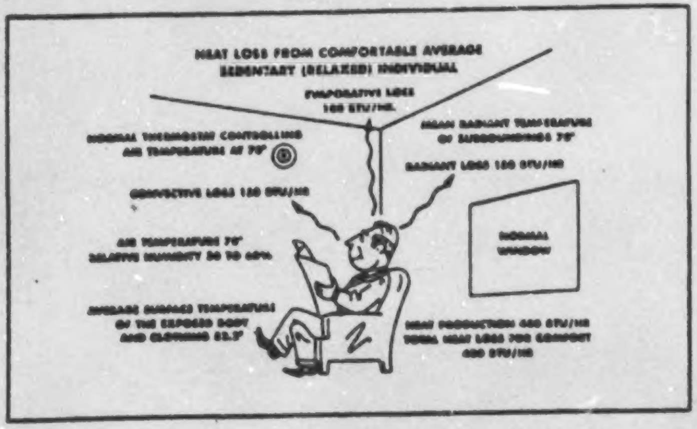
Note: The addition of a second reflective surface facing the first reflective surface increases thermal resistance values of an air space only 4 to 7 percent.

Surface air films	
INSIDE (still air)	
Heat flow UP (through horizontal surface)	
Non-reflective	R-0.61
Reflective	R-1.32
Heat flow DOWN (through horizontal surface)	
Non-reflective	R-0.92
Reflective	R-4.55
Heat flow HORIZONTAL (through vertical surface)	
Non-reflective	R-0.68
OUTSIDE	
Heat flow any direction, surface any position	
15 mph wind (winter)	R-0.17
7.5 mph wind (summer)	R-0.25
Glass	
Single glass (winter)	U=1.13
Single glass (summer)	U=1.06
Insulating glass (double)	
1/4" air space (winter)	U=0.65
1/4" air space (summer)	U=0.61
1/2" air space (winter)	U=0.58
1/2" air space (summer)	U=0.56
Storm windows	
1" to 4" air space (winter)	U=0.56
1" to 4" air space (summer)	U=0.54

*Additional resistance values can be obtained from ASHRAE Handbook of Fundamentals published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

BASIC ELECTRIC HEATING

PART I


HEAT LOSS FROM COMFORTABLE AVERAGE SEDENTARY (RELAXED) INDIVIDUAL
EVAPORATIVE LOSS 100 BTU/HR.
NORMAL THERMOSTAT CONTROLLING AIR TEMPERATURE AT 75°
MEAN RADIANT TEMPERATURE OF SURROUNDINGS 75°
RADIANT LOSS 180 BTU/HR
CONVECTIVE LOSS 120 BTU/HR
AIR TEMPERATURE 75° RELATIVE HUMIDITY 30 TO 60%
NORMAL WINDOW
AVERAGE SURFACE TEMPERATURE OF THE EXPOSED BODY AND CLOTHING 83.5°
HEAT PRODUCTION 400 BTU/HR TOTAL HEAT LOSS FOR COMFORT 400 BTU/HR

As conditions in the room and physical activity change, the body heat loss rates also change.

The Components of Comfort: Do You Remember Them?

The first in a series of articles about electric comfort conditioning fundamentals tells what constitutes comfort, and how.

Indoor comfort is the most important commodity that those in the electric comfort conditioning business should offer. Developing an atmosphere of comfort requires the elimination of any factors that can detract, including not only temperature, but humidity, cleanliness, air distribution and odor conditions.

Heating comfort depends on maintaining the balance between body heat production and body heat loss. The human body burns fuel (food) to produce heat energy that can be converted into work.

Unless the heat generated by the body can be rejected at the same rate it is produced, the body temperature will rise or fall to try to compensate for the difference. At some point discomfort will be felt.

Under moderate conditions the body matches heat production to heat loss by actually changing its surface temperature (by increasing or decreasing the flow of blood to the skin). If conditions become extreme, the body will compensate further by perspiring, increasing evaporative cooling, or by shivering, increasing the production of heat.

From the standpoint of heating, therefore, a room may be considered comfortable when the occupant can get rid of body heat at the same rate he produces it—and can do so with no definite compensation by the body's regulating mechanism.

HEAT TRANSFER

Our body follows the basic laws of heat transfer in disposing of heat to the surroundings. Air and room surfaces must be cooler, on the average, than the surface of the body because heat flows only from a region of higher temperature to one of lower temperature. Heat transfer may occur through any of four processes: convection, radiation, evaporation and conduction. Frequently a combination of two or more of these processes is involved.

Convection is the transfer of heat from a solid material to a liquid or a gas (such as air) which moves across the surface and carries heat away. An example of convection is the transfer of heat to air as it passes over baseboard convector fins. A reverse transfer occurs if fins are cooler than air, as in a cooling unit.

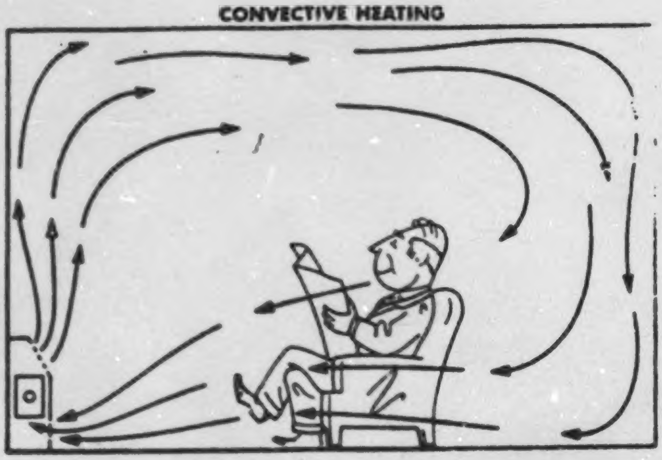
Radiation is the transfer of energy from the surface of an object by electromagnetic waves—such as ultraviolet, visible light and infrared waves. For heating applications, infrared heat waves are most important. They travel through space in much the same manner as visible light rays, and heat the objects they strike. Practically speaking, radiation does not heat the air as it passes through.

Evaporation is another method of heat transfer used by the body. When moisture on the skin is exposed to the air, it diffuses into the air as water vapor. A relatively large amount of heat is required to convert water into vapor, and some of this heat is extracted from the skin.

Conduction is the flow of heat

continued on page 30

CONVECTIVE HEATING



With a heating element near the floor, circulating force is available because of differences in the density of cool and warm air.

through a material (especially a solid) from point to point, or from one object to another in contact with it. Conduction is not very important in body heat transfer.

BODY HEAT LOSS RATES

Under conditions which are comfortable for the average adult in typical indoor clothing, the body must get rid of about 400 Btu per hour. This is about the same heat output as that produced by burning 400 kitchen matches per hour. If room conditions are within the comfort range and nearly uniform, heat loss is divided approximately as follows: by conduction, negligible; by evaporation from skin, clothing and lungs, about 100 Btuh; by convection, about 150 Btuh; by radiation, about 150 Btuh.

FACTORS AFFECTING HEAT LOSS

Although temperature control is the single most important factor in comfort control, in the control of body heat loss rates, three main factors in the environment must be considered: temperature (air and radiant), air movement and relative humidity.

Air temperature: Large differences in air temperature can occur at different levels and locations in the room. These differences are called temperature gradiants and can cause uncomfortably high or low rates of convective heat loss from different parts of the body.

Many researchers report that people seem more sensitive to repeated ups and downs in temperature (temperature "swings") of as little as two degrees than to larger changes occurring gradually over a longer period of time.

One aspect of room temperature that has been getting increased attention is "mean radiant temperature," which is the combined effect of wall, floor and ceiling temperature on radiant heat loss from the occupant's body.

The cooler the surrounding room surfaces, the more heat the body loses to them by radiation. In addition, the larger the area of a cold outside wall and the closer the body is to this wall, the greater the "cold-wall" effect.

The result is that the mean radiant temperature is different at each point in the room unless all exposed surfaces are at exactly the same temperature. Even if the calculated average mean radiant temperature appears to be "just right" for comfort, an occupant can still feel uncomfortable in some parts of the room.

Air movement: Movement of air in the room affects the rate of convective heat loss, and, to some degree, the evaporation rate.

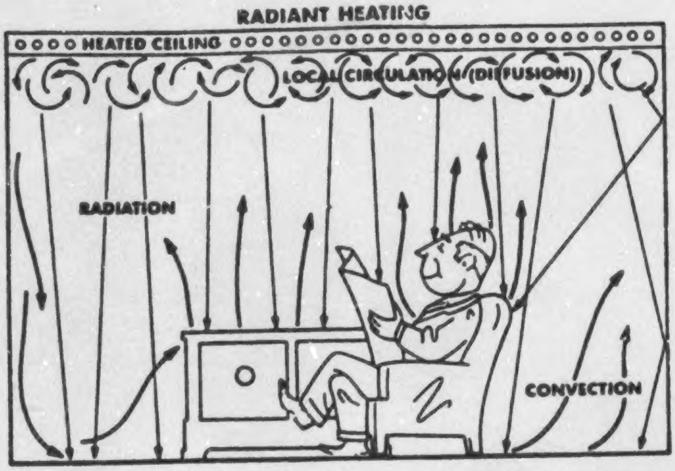
Because the heat-storage capacity of air is small, it takes a considerable amount of air to carry away even small quantities of heat. Air movement occurs even in a room where the air seems to be still. For example, the ASHRAE Guide refers to air velocities of 15 to 25 feet per minute as still air.

At times and at certain points in a room, however, local air movement may occur at considerably higher velocities. One may feel a "cold draft" when seated near a fan, even though the temperature of the air is in the 75–80° F. range. Air movement also has some effect on evaporative heat loss, although the effect is generally not conspicuous unless there is definite flow of perspiration.

Occasionally, the effect of air movement on room occupants must be considered from a psychological standpoint. For example, a family moving from a home heated by radiators into one with a forced-air system may complain that the rooms seem "drafty" regardless of good diffusion and a nearly constant thermometer reading.

Relative humidity: Relative humidity is the ratio of existing moisture content to the maximum amount of moisture the air could hold at the existing temperature. If the relative humidity is 100 per cent, the air is saturated. Relative humidity can be increased by adding moisture to the air, or lowering the temperature without removing moisture. Similarly, raising the temperature reduces the relative humidity, although the actual amount of moisture remains the same.

RADIANT HEATING



The behavior of radiant heat source depends upon its location with respect to room surfaces

In older houses having a large amount of infiltration of air and lacking effective vapor barriers, the problem is usually one of keeping the humidity high enough. Cold outside air enters the house and becomes very dry when heated to indoor temperature. Warm indoor air carries its moisture outdoors, and vapor in the indoor air diffuses through the walls and roof.

Tightly built newer homes, like those built with electric heat in mind, have effective vapor barriers as part of the insulation or separately.

Excessive humidity is often controlled by the use of exhaust fans, which may be automatically operated from a humidistat.

MAINTAINING COMFORT CONDITIONS

An effective heating system must replace heat lost from the house, at the proper rate to maintain comfort temperatures, and deliver it in such a way that air movement and other factors will also contribute to comfort. Of the types of heat transfer mentioned, convection and radiation are important in the delivery of heat to the occupied space. Both occur together, but the relative amount of heat delivered by each varies widely.

Convective heat transfer depends on air movement over the heated surface in the heating equipment and then into the room. The convector or heat delivery surface may be in the room or in a central furnace with ducts leading to room registers.

The circulation of air over the convector surface may be produced by a fan or blower, or by gravity. For effective circulation by gravity, or natural convection, the convector surface must be placed low enough in the room to provide some "stack" effect. In this way, circulating force is available because of differences in the density of cool and warm air.

Two other factors are important in determining how effective heat transfer by convection will be. One is the temperature of the heat-exchanger surface: the larger the temperature difference (surface to air) the greater the heat transfer. The other factor is the size of the warm surface exposed to the moving air: the larger the surface area, the larger the quantity of air that comes into contact with the surface in a given time. This is why fins are used to increase the surface area of heating elements in a baseboard convector.

Convective heating delivers heat to the room mainly by mixing warm air with the cooler air in the room, but the warm air movement also delivers some heat to the cooler surfaces it wipes.

Radiant heat input to a room occurs primarily by radiant heat transfer from the heating surface to one or more of the room surfaces. These in turn deliver some heat to the air by convection, so the lower their location in the room, the more effective they are as convectors, because of the "stack" effect.

Notice in the accompanying diagram that air warmed by contact with a heated ceiling has almost no place to go. It cannot go up through the ceiling, and it cannot go down and displace the denser, heavier cool air below. It circulates a little, by diffusion and some convective motion in the layer next to the ceiling, but this contributes little to distribution of heat in the room.

Some general convective circulation does occur, however, as warm air rises from surfaces heated by radiation received from the ceiling. Most of the cooler air which displaces the warm air, and thus provides the circulating force, flows down along the relatively cold outside walls.

Thus the behavior of the radiant heat source depends upon its location with respect to room surfaces. If it faces the floor, for example, the floor will deliver a large part of the total heat input to the air by convection.

Therefore, in locating a radiant heating unit, there are two important considerations: the direct effect on mean radiant temperature nearby, and the indirect effect throughout the room because of heat it transmits to other surfaces. ☐ ☐

SOURCE

☐ *This series of articles is based on "Fundamentals of Electric Heating," a new training program offered by Honeywell, Inc.*

PROJECT EFFECT

IUSB

HEATING SYSTEM CHECK LIST (Gas Furnace)

1. Clean and light the pilot
2. Test the pilot safety
3. Check and oil fan motor
4. Check blower and fan belt; oil blower bearings
5. Text fan control operation
6. Test limit control operation
7. Test gas valve operation
8. Check gas burner operation
9. Check thermostat operation
10. Check filters (usually replace)

HEATING SYSTEMS -EXAM

1. What three words do the initials "B.t.u." stand for?

2. If we have 4 layers in a wall, and layer 1 has an "R: value of 0.75 and layer 4 an R value of 0.50, layer 3 an R value of 1.00 and layer 4 an R value of 0.25, what is total "R" value for the wall?

3. If a wall has an "R" value of 2.0, what is the "U" value of the wall in Btu per hour per square foot per degree temperature difference?

4. If you had a wall with a net area of 100 square feet and a temperature difference of 80 degrees, what would the heat loss be in Btu's per hour if you used the "U" factor found in #3 above?

5. Name two of the electrical controls found on an automatic heating system.

6. Name two disadvantages of a gravity warm air heating system.

INSTRUMENTATION

The following materials are used to meet the Instrumentation module objectives in Volume i (p. 49).

Objective	Resource
1 & 3	Equipment demonstrated in Physics lab by instructor.
2	*Understanding and Using Electricity*, see reference in Electricity module.
Evaluation	Exam Resource A

PROJECT EFFECT - IUSB

Wrap-up EXAM

I. Instrumentation (50 points)

1. Describe how you would determine if a stick fuse was burned out using a volt-ohm-meter (VOM).

2. Describe three types of thermometers and explain how they work i.e., what changes with temperature and how this change is indicated.

3. Describe the operation of a flue-gas analyser.

II. Motors (50 points)

Write the letter code for the motor or motors that has the stated characteristic.

A. Universal (AC-DC) motor
B. Split phase motor
C. Capacitor type motor
D. Three phase motor
E. Replusion motor

_______ 1. Has brushes

_______ 2. Has lowest starting torque of those listed

_______ 3. Used in hand drill

_______ 4. Used in furnace blowers

_______ 5. Non-syncronis (speed depends on load)

INSULATION MATERIALS AND TECHNIQUES

The following materials are used to meet the Insulation Materials and Techniques module objective in Volume i (page 52).

Objective	Resource
1	ASHRAE Handbook of Fundamentals, chapter 20, 1972.
2, 3, 4 & 5	Materials provided by insulation contractor "Study of Various Insulation Materials", Home Weatherizing Manual pages 10-35, TVA Energy Conservation Materials.
3, 4 & 5	"Insulating Values of Materials", Anderson, B., The Solar Home Book, pages 274-279.
3, 4 & 5	"Insulation Manual", National Association of Home Builders, Inc.
6	Infra-red scanner introduced by insulation contractor
Evaluation	Exam - Resource A.

PROJECT EFFECT INSULATION - EXAM

1. Define U value.
2. Name two mineral insulations.
3. Give the resistance value (R) when the U value is 0.08.
4. Name the three types of foam insulation.
5. Define the C value.
6. Explain the location of a vapor barrier in a house wall section.
7. Give the ratio of free air to the square feet of attic space required for proper ventilation.
8. Define K value.
9. Explain degree days.
10. Should a crawl space be ventilated?
11. Does insulation deteriorate? Justify answer.
12. Name two forms of heat tranfer or flow.
13. Explain paint peeling of exterior wood siding.
14. Give direction of heat flow.
15. Explain what must be done to house at 1909 Oaklawn to bring to minimum property standards for building insulation.

Sidewalls	U - 01008
Ceiling	U - 0.05

4500 to 8000 degree days

Walls

Outside air film

No wall insulation (3½" air space (2 x 4 studs) 16" on-center)

8" wood lap siding

½" fiber board sub-siding

Lath & plaster interior finish

Inside air film

Ceilings

No ceiling insulation

2" x 6" ceiling joist 16" on-center (6" air space)

1" wood sheathing (deck)

Building paper

Asphalt shingles

Lath & plaster

Outside air film

Second floor has knee walls

No ventilation

RESOURCE A

PROJECT EFFECT

May, 1978

INSULATION MAKE-UP EXAM

(one evening to complete)

1. If the resistance value (R) is 12.05, what is the U value? (show all work on paper)

2. Why is it desirable to ventilate attics, walls, and crawl spaces (distinguish between winter and summer)?

3. Name two advantages to foam insulation. Name two disadvantages.

4. Explain how a vapor barrier works and why it is important in insulating. Name two situations where you would not use a vapor barrier.

5. Explain why heating degree days are important to a heating contractor.

RESOURCE A

6. Explain what must be done to house at 1909 Oaklawn to bring to minimum property standards for Building insulation.

    Sidewalls U - 0.08
    Ceiling U - 0.05
    4500 to 8000 degree days

Walls No Wall Insulation
½" Wood Lap Siding
½" Fiberboard Sub-siding
2 x 4 Studs 16" on-center
3/4" Lath & Plaster interior finish
3/4" soft wood paneling

Ceiling
2" rock wood ceiling insulation
2" x 6" ceiling joist 16" on center
1" Wood Sheathing (deck)
Building paper
Asphalt shingles
3/4" Lath & Plaster interior finish
Second floor has knee walls

No Ventilation

Make specific recommendations about the following:

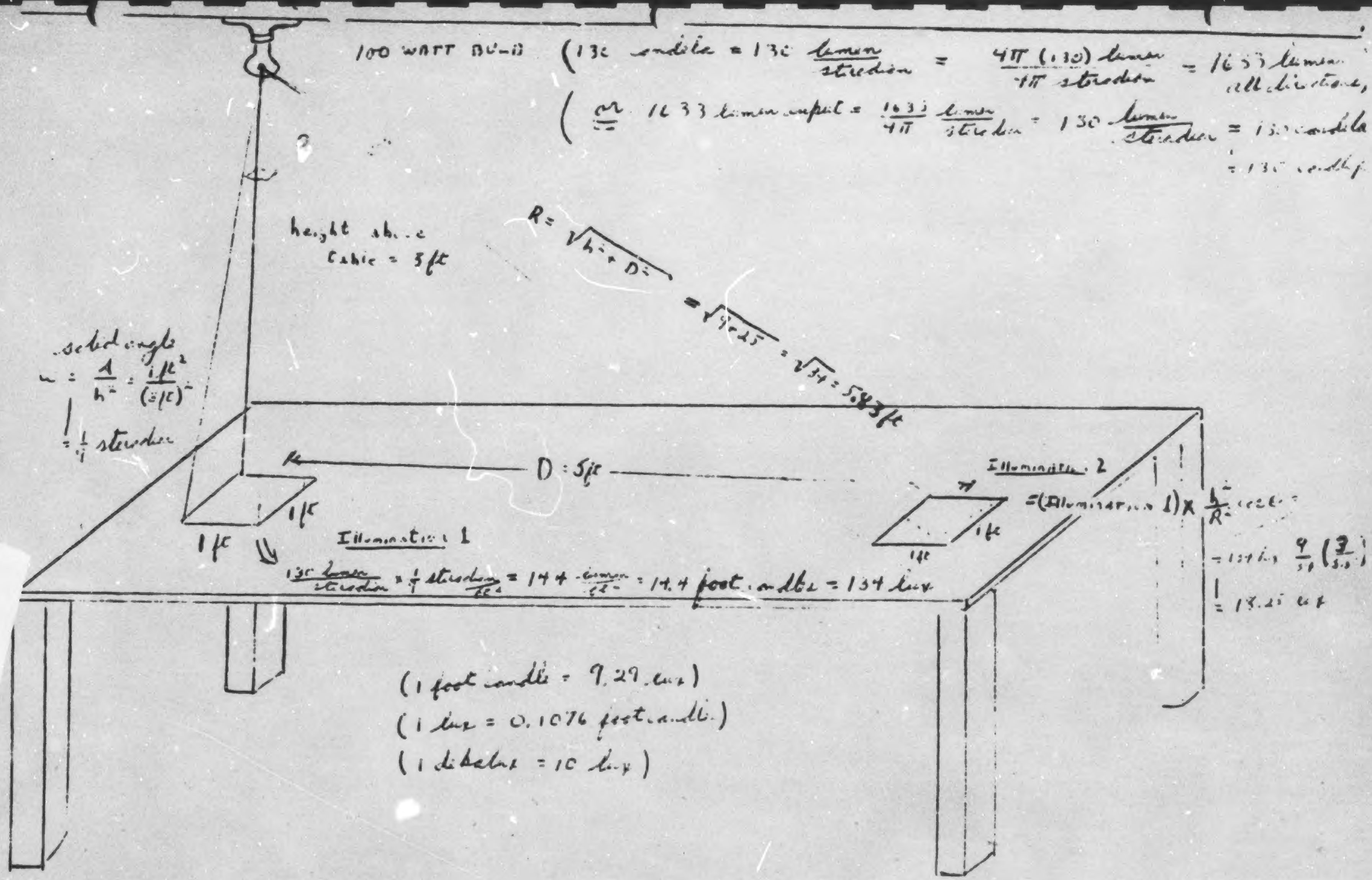
1. Type, amount, and estimated cost of wall insulation.
2. Type, amount, and estimated cost of ceiling insulation.
3. Ventilation modifications - additions.

RESOURCE A

LIGHTING EFFICIENCY

The following materials are used to meet the Lighting Efficiency module objectives in Volume i (p. 56).

Objective	Resource
1	Lecture materials and refer to handout Electricity and Wiring, (see Electricity module).
2	Lecture materials and Lighting Surveys of two residences.
3	Sample problems Resource A; foot candle meters.
Evaluation	Exam Resource B


100 WATT BULB
(130 candela = 130 lumen/steradian = 4π (130) lumen / 4π steradian = 1633 lumen all directions,
(or 1633 lumen output = 1633/4π lumen/steradian = 130 lumen/steradian = 130 candela
= 130 candle
θ
height above table = 3 ft
R = √(h² + D²) = √(9+25) = √34 = 5.83 ft
solid angle
ω = A/h² = 1 ft²/(3 ft)²
= 1/9 steradian
D = 5 ft
1 ft
1 ft
Illumination 1
130 lumen/steradian × 1/9 steradian/ft² = 14.4 lumen/ft² = 14.4 foot candles = 134 lux
Illumination 2
= (Illumination 1) × h²/R² cos θ
= 134 lux 9/34 (3/5.83)
= 18.25 lux
1 ft
1 ft

(1 foot candle = 9.29 lux)

(1 lux = 0.1076 foot candle)

(1 dekalux = 10 lux)

(4π = 12.5)

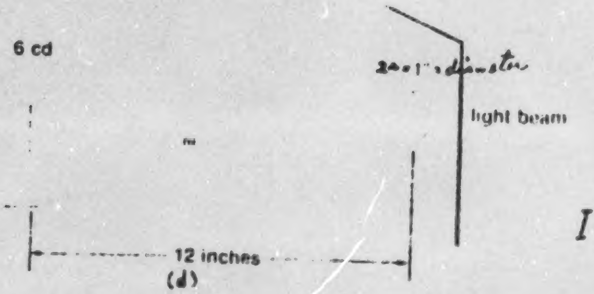

6 cd
2r = 1" diameter
light beam
12 inches
(d)

Figure 5-7 Given the source intensity, how many lumens of light flux go through the hole shown?

$I = 6\text{ cd} = 6$ lumen/steradian

$\omega = \frac{\pi r^2}{d^2} = \frac{\pi(\frac{1}{4})}{144} = 0.00545$ strad

flux through hole $= I\omega = 6(0.00545)$

$= \underline{0.0328}$ lumens

EXAMPLE 1

Find the solid angle at the apex of a cone which has a circular base 5 cm in diameter and sides which are 12 cm long. These are the approximate dimensions of an ice cream cone.

The area of the base is $\pi d^2/4$. This is the flat area, but it will be close to the curved area and the error will be recognized.

$$A = \pi(5\text{ cm})^2/4$$

$$= 19.6\text{ cm}^2$$

$$r = 6\text{ cm}$$

$$\omega = A/r^2 = 19.6\text{ cm}^2/6^2\text{ cm}^2$$

$$= 0.54$$

The solid angle at the apex is 0.54 steradian.

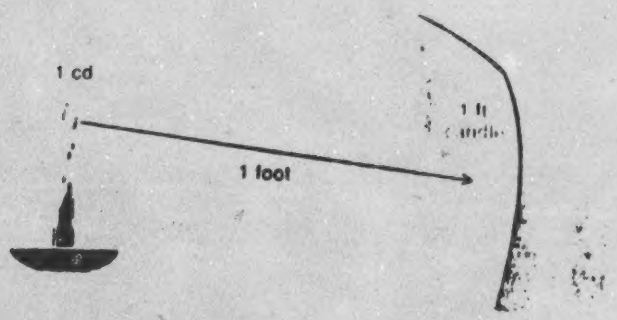

1 cd
1 ft
candle
1 foot

Figure 5-9 The old foot candle of illumination.

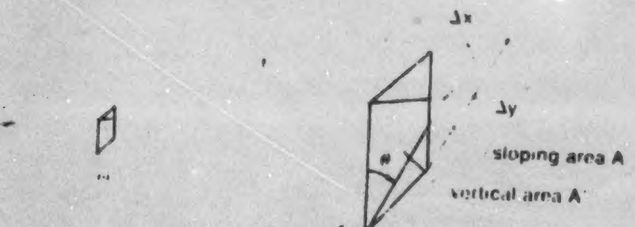

Δx
Δy
sloping area A
θ
vertical area A'
Δy cos θ

Figure 5-13 Finding a solid angle if the base is not normal to the axis of the small cone but has been tilted by an angle θ.

$\omega =$ [illegible]

EXAMPLE 2

Consider a small light source of 6 candelas (approximately 6 candlepower), at a distance of 1 foot (12 inches), a hole of area 1 square inch is cut in a screen as in Figure 5-7. How many lumens go through the hole? The solid angle was $1/12^2$ or 1/144 steradian. The source is emitting 6 ~~candelas~~ lumen per steradian, so in 1/144 of a steradian there are 6/144 or 1/24 of a lumen.

EXAMPLE 3

If a source is known to emit 4 lumens in a solid angle of 0.01 steradian, the intensity is 4 lumens per 0.01 steradian or

$$I = \frac{4\ \text{lumens}}{0.01\ \text{steradian}} = 400\ \frac{\text{lumens}}{\text{steradian}}$$

EXAMPLE 4

If the intensity of illumination on an area of 2 cm^2 is 1000 lux, how many lumens are falling on that area? (1000 lux is a good level of illumination for a lab.) Also, how many watts are incident on the area if the light is white, similar to the standard candle?

One thousand lux implies 1000 lumens per square meter. The area in question is 2 cm^2 or $2 \times 10^{-4}\ m^2$. The number of lumens is

$$L = \frac{1000\ \text{lumens}}{m^2} \times 2 \times 10^{-4}\ m^2$$

$$= 0.2\ \text{lumens}$$

One lumen is equivalent to 0.00146 watts, so we may replace the word lumen by its equivalent. The power flow onto the area is then

$$0.2 \times 0.00146\ \text{watts} = 0.292\ \text{milliwatts}$$

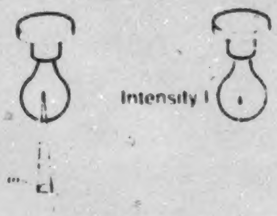
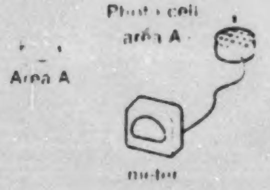


Figure 5-10 The intensity of illumination at a distance r from a source of intensity *I* is given by I/r^2.



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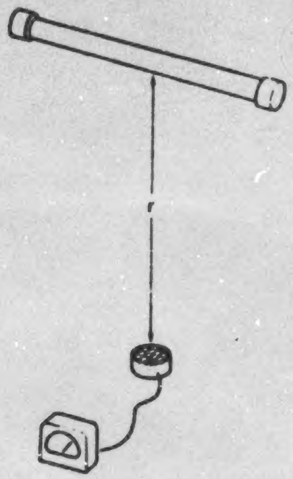

Figure 5–11 From a linear source emitting I candelas per unit length, the illumination intensity is $2I/r$.

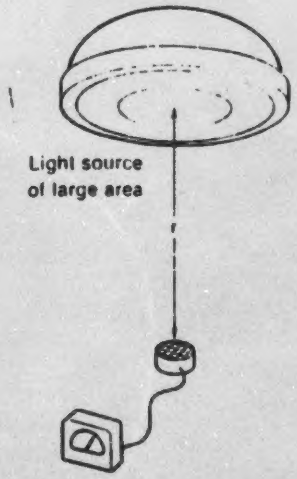
Light source
of large area
r

Figure 5–12 Area illumination: there is no decrease in intensity with distance.

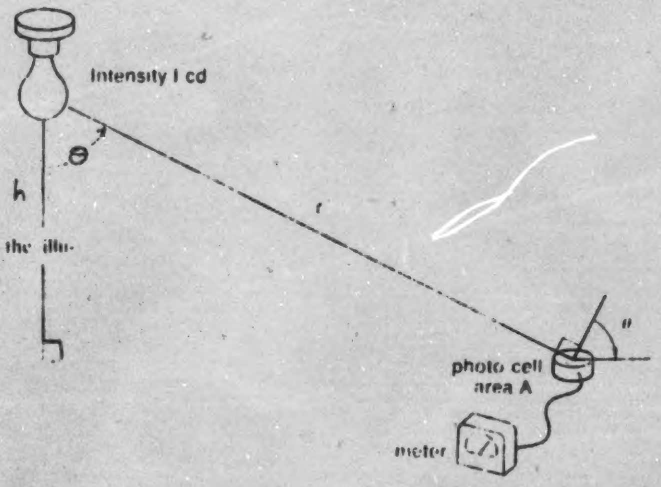
Intensity I cd
θ
h
r
θ
photo cell
area A
meter

Figure 5–14 Oblique illumination: the illumination is $I_c = I \cos \theta / r^2$.

$\cos \theta = \frac{h}{r}$

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Project EFFECT
Lighting Module Test

1. (2 points) $2x + 1 = 5$; $x = ?$

2. (2 points) $2x + 8 = x - 8$; $x = ?$

3. (4 points) $x + y = 9$ $x = ?$
$x - y = 1$; $y = ?$

4. (3 points) A one candle power light source (a candle?) emits how many lumens in all directions?

5. (3 points) A one candle power light source emits how many lumens into a solid angle of 1 steradian?

6. (4 points) If a Sylvania 60 watt Soft White bulb emits 800 lumens, what is the approximate candle power of this light?

7. (4 points) What is the luminous effeciency of the bulb in question six in lumen per watt?

8. (4 points) One lumen is 1.46 milliwatt of light energy. For the bulb in question 6, how many watts of light energy do you get per electrical watt of power into the bulb?

9. (3 points) What is the illumination on a surface that is one foot from a point light source of intensity one candle power?

10. (4 points) What is the illumination on a surface that is two feet from a point light source of 2 candle power?

11. (5 points) What is the illumination on a surface that is two feet from a point source that emitts 250 lumens?

12. (4 points) What is the recommended illumination level for typing in an office in foot candles? In dekalux?

13. (2 points) A dekalux is how many lux?

14. (5 points) A 50 watt G.E. bulb emits about 600 lumens. If this bulb was placed 4 feet above a level surface, what is the illumination on that surface directly below the bulb?

15. (5 points) How many lumens should the bulb emit if the illumination in question 14 is to be 100 foot candles?

16. (4 points) Besides the illumination level, what other things should be considered in design lighting. (Name two)

17. (4 points) Name some advantages of incadescant lighting.

18. (4 points) Name some disadvantages of incadescant lighting.

19. (4 points) Why wouldn't you recommend sodium vapor lamps for a window display of a department store?

20. (4 points) Which is more efficient, a 100 watt incadescent bulb or a 100 watt fluroescent bulb.

21. (4 points) True or False, turning a fluorescent light on takes as much power as leaving the bulb on for 5 minutes.

22. (10 points) If a candle (one candle power) is placed in a candle stick so that the flame is 1 foot above the dining room table, what is the illumination at a plate, on the table, three feet from the base of the candle stick?

23. (4 points) If you find the illumination on a surface that is 2 feet from a single light bulb in 100 lux, what will be the illumination when the surface is moved away to 4 feet from the bulb?

24. (4 points) If you measure the illumination on a surface that is 2 feet from the center of a row of fluorescent bulbs in 200 lux, what will be the measured illumination at a distance of four feet?

25. (4 points) Why is a "ballast" needed in a fluorescent light fixture?

WEATHER

The following materials are used to meet the Weather module objectives in Volume i (p. 58).

Objective	Resource
1	Lecture presentation using weather maps and weather instruments
2	Climatological data from local weather bureau.
3	Handout exercise on Intensity of Insolation at the Earth's Surface Resource A.
3	Handout exercise on Earth-Sun Relationships Resource B
3	Handout exercise using the analemma Resource C.
4	Handout on Cooling Power of Wind Resource D.
5	Psychometric chart and tables Resources E & F.
5	Map of world with sun angles, Resource G Climatological data from local weather bureau.
Evaluation	Exam - Resource H

INTENSITY OF INSOLATION AT THE EARTH'S SURFACE

Altitude of Sun	Relative Length of Sun's Rays Path* Through Atmosphere	Intensity of Radiation at Earth's Surface: In Per Cent of Solar Constant[1]	Intensity of Radiation at Earth's Surface: In Per Cent of Insolation at 90° Altitude of Sun
90°	1.00	78%**	100%
80°	1.02	77%	99%
70°	1.06	76%	97%
60°	1.15	75%	96%
50°	1.31	72%	92%
40°	1.56	68%	87%
30°	2.00	62%	79%
20°	2.92	51%	65%
10°	5.70	31%	40%
5°	10.80	15%	19%
0°	45.00	0%	0%

*The length of the sun's rays at an altitude of 90° (vertical) is given a value of unity (1.00).

**78% is the Coefficient of Transmission. This is the fractional part of the Solar Constant remaining after a sun's ray has passed through the atmosphere.

13. Find the height of the sun at noon, June 21st at your present Latitude.

____

Use the following formula:

Height of the Sun in degrees = 90° - (Number of degrees between your Latitude and and that of the Sun)

14. What is the relative distance a ray of light must travel through the atmosphere at your latitude compared with that where the Sun's rays fall vertically upon the earth (90°)?

________________________________%

15. At your Latitude on June 21st what per cent of the Solar Constant is available for heating of the Earth's surface? The time is noon.

________________________________%

---

[1] The solar constant is the amount of radiation received on a unit area at the outer edge of the atmosphere. It amounts to 1.94 calories per square centimeter per minute.

LENGTH OF DAY AT EACH 10° DEGREES OF LATITUDE

Latitude	March 21	June 21	Sept. 22	December 21
0°	12 hrs	12 hrs 0 min	12 hrs	12 hrs 0 min
10°	12 hrs	12 hrs 35 min	12 hrs	11 hrs 25 min
20°	12 hrs	13 hrs 12 min	12 hrs	10 hrs 48 min
30°	12 hrs	13 hrs 56 min	12 hrs	10 hrs 4 min
40°	12 hrs	14 hrs 52 min	12 hrs	9 hrs 8 min
50°	12 hrs	16 hrs 18 min	12 hrs	7 hrs 42 min
60°	12 hrs	18 hrs 27 min	12 hrs	5 hrs 33 min
70°	12 hrs	2 months	12 hrs	00 hrs 00 min
80°	12 hrs	4 months	12 hrs	00 hrs 00 min
90°	12 hrs	6 months	12 hrs	00 hrs 00 min
Latitude	Sept. 22	December 21	March 21	June 21

Note - Read up for Southern Hemisphere.

16. Contrast the amount of insolation in calories on one square centimeter at 40° North Latitude with a like area at the Equator for June 21st.

		40° N. L.	Equator
Calculate:	A. SUN ANGLE Altitude of the Sun at noon:	________°	________°
	B. Divide altitude of Sun at noon by 2 to get approximate altitude average for daylight period	________°	________°
	C. DURATION OF DAY Multiply average altitude of daylight sun by the number of hours of sunlight	________	________
	D. Multiply the answers in "C" by intensity of radiation at Earth's surface in per cent of the Solar Constant for the respective Latitudes	________	________
	E. Multiply each answer in "D" by the number of calories of heat received per hour on a Centimeter-square area at the edge of the atmosphere. (60 × the Solar Constant)	________	________

17. In Question 16, which unit area receives the most insolation during June 21st?

____

Explain.____

Part A - Earth-Sun-Relationships

MATERIAL: World Map

While the astronomer thinks of earth - sun relationships as viewed from within the solar system, the geographer thinks of them chiefly as viewed from the earth's surface. This exercise is designed to give you a picture of the sun's movement across the sky in the various parts of the earth's surface and at various times of the year. The nature of these movements across the sky for any particular latitude throughout the year determines primarily the amount of insolation received at a certain place. Since insolation is the chief source of heat on the surface of the earth, an understanding of these movements is necessary to an understanding of the differences in temperature and climate at a given place. In addition the noon sun is one of the landscape evidences of the latitude by which man may locate himself on the earth.

1. On the base maps of the world, print the following statements along the proper latitude line as directed:

   a. On the equator "Sun at zenith at noon March 21 and September 21."
   b. On the Tropic of Cancer and Capricorn respectively, "Sun at zenith at noon June 21" and "Sun at zenith at noon December 21."
   c. Draw in the 11 degree N. Latitude line and on it write "Sun at zenith at noon on April 21 and August 21".
   d. On latitude 21 degree N. write "Sun at zenith at noon May 21 and July 21."
   e. Fill in the vertical position of the sun south of the equator in the same manner using the appropriate dates.
   f. Draw a red line across the map at the Tropic of Cancer and Capricorn and write in the following generalizations across the map between the two tropics on the right side. "The belt between the two tropics is the only place on the earth's surface where the noon sun is seen at the zenith."
   g. Add to the above generalization a second one which applies to this belt and which you derive by study of the above statements.
   h. Draw a red or heavy line along the polar circles and write in the following between the Tropic of Cancer and the Artic Circle. "Noon sun Always in the southern sky, as far from zenith as one is from the point where the noon sun is at the zenith on that day; sun highest on June 21, and lowest on Dec. 21; no day more than 24 hours in length."
   i. The sun at Chicago, (42^{o} N.L.) never reaches the zenith and at noon is always in the southern sky. How high above the southern horizon is the noon sun at Chicago on March 21? on April 21?
   j. Write between the Tropic of Carpicorn and the Antarctic Circle a generalization similar to that given for its northern counterpart, but change to meet the conditions in the southern hemisphere.
   k. How far is the sun above the horizon at Chicago (42^{o} N latitude) when it is at zenith?
      1. At the equator?
      2. At 11 degrees S.L.?
      3. At 20 degrees S.L.?
      4. At 23½ degrees S.L.?

Laboratory Exercise #1 Cont'd

l. How far is the sun from the horizon when it is lowest in the sky at Chicago? How far is the sun from the horizon when it is highest in the sky at Chicago?

m. How far above the horizon at Rio DeJaneiro (22° S.L.) when it is at zenith?

1. At the equator?
2. At 11 degrees S.L.?
3. At 20 degrees N.L.?
4. At 20 degrees S.L.?

n. How far above the horizon at Sydney (35°) Australia when it is at zenith?

1. At the equator?
2. 20° S.L.?
3. 16° N.L.?

o. How far above the horizon at Moscow (57° N.L.) when it is at zenith?

1. At equator?
2. At 23½ N.L.?
3. At 23½ S.L.?

Part B - Instruments (Observation and Recording)

MATERIALS: Weather Chart

INTRODUCTION:

Of primary importance in any course associated with weather or climate is the need to gain an acquaintance with the instruments used for various measurements and in the accepted methods of recording such data. Generally the instruments may be divided into those used in recording temperature; pressure; wind; and precipitation.

READING INSTRUMENTS

Temperature instruments.

1. Fahrenheit thermometer-it should be noted that 32° is freezing and 212° boiling point.
2. Maximum - Minimum Thermometer -- The blue magnets in the instrument should be pressed against the mercury columns by means of a small outside magnet. After 24 hours has passed readings may be taken at the bottom of the blue magnets; the reading on the right indicates maximum T. and on the left the minimum T. After each reading the magnets must again be set against the mercury.
3. THERMOGRAPH - secondary

Pressure and Wind Instruments.

1. Mercury Barometer - denotes rise and fall in air pressure. Lighter air will effect a drop and heavier air a rise in the level of the Mercury column. Readings should be taken in thousands of an inch on the scale to the right of the column. Counting should begin at the nearest whole number moving upward with each .05 mark until even with the mercury level. After the final barometer reading, 0.62 inches must be added to adjust to sea level.
2. Aneroid Barometer - Readings are made similar to those on the mercury barometer, except that compensation is already made for altitude above sea level.
3. Barograph - Indicates hour for hour change in air pressure.
4. Anemometer - Indicates wind direction and velocity. Velocity is noted by the number of times the green light flashes per minute. (Note correction scale on instrument.) Direction is noted by the white light having wind direction abbreviations.

Laboratory Exercise #1 Cont'd

Precipitation and Humidity Measurements:

1. Rain Gauge - Volume of the top receiver is 10 times that of the container. Thus the actual rainfall amount is 10 times less than the total level accumulated in the tube. This enables more accurate measurement with one inch in tube totaling one-tenth inch actual precipitation.
2. Sling-psychrometer - Denotes relative humidity recordings. Basically the instrument consists of wet and dry bulb thermometers. After swinging the instruments, readings are taken from both thermometers. The wet reading (lower) is subtracted from the dry bulb reading. This difference and the temperature on the dry bulb are necessary to obtain relative humidity from provided table.
3. Humiguide - Provides essentially the same data as the psychrometer but tends to be less accurate.

Station South Bend　　Latitude 41° 42' N　　Longtitude 86° 19' W.
Elevation 773 ft.　　Source Instruments

EXERCISES:

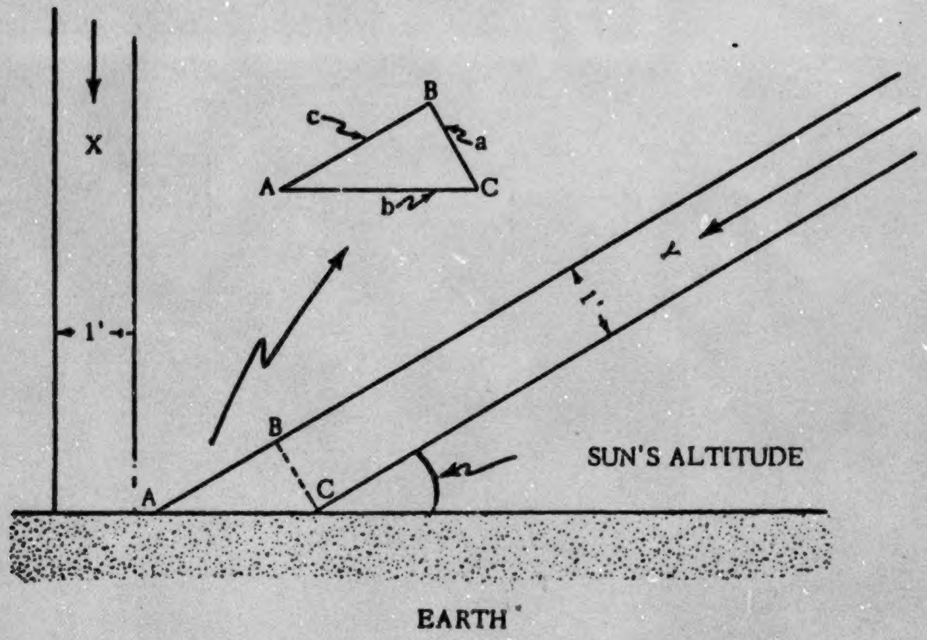
1. Study carefully "Summary for Month" on Weather Chart.

2. When pressure decreases:
   a. What is corresponding temperature tendencies?
   b. What is cloud condition?
   c. What are prevailing wind directions?
   d. What is relation to precipitation? (Note Dates and specific measurements for each answer.)

3. On days of considerable cloud cover:
   a. What is the trend in daily temperature range?
   b. What is tendency in relative humidity?
   c. What is the prevailing wind direction?
   d. What is the barometric tendency? (Note Dates and specific measurements for each answer.)

4. When temperature is comparatively high:
   a. What is the corresponding pressure tendency?
   b. What is the most dominant wind direction?
   c. Does it tend to be more or less cloudy than at times of low temperature?
   d. Is precipitation more frequent? (Note Dates and specific measurements for each answer.)

5. From a study of the above facts as brought out from the Weather Chart, construct as many basic principles noting relationships between elements of weather as you can. For example: Lower Pressure - Higher temperature.



(38-47)

Given: The date is October 20th, you are in South Bend, Indiana (Latitude 41° North).

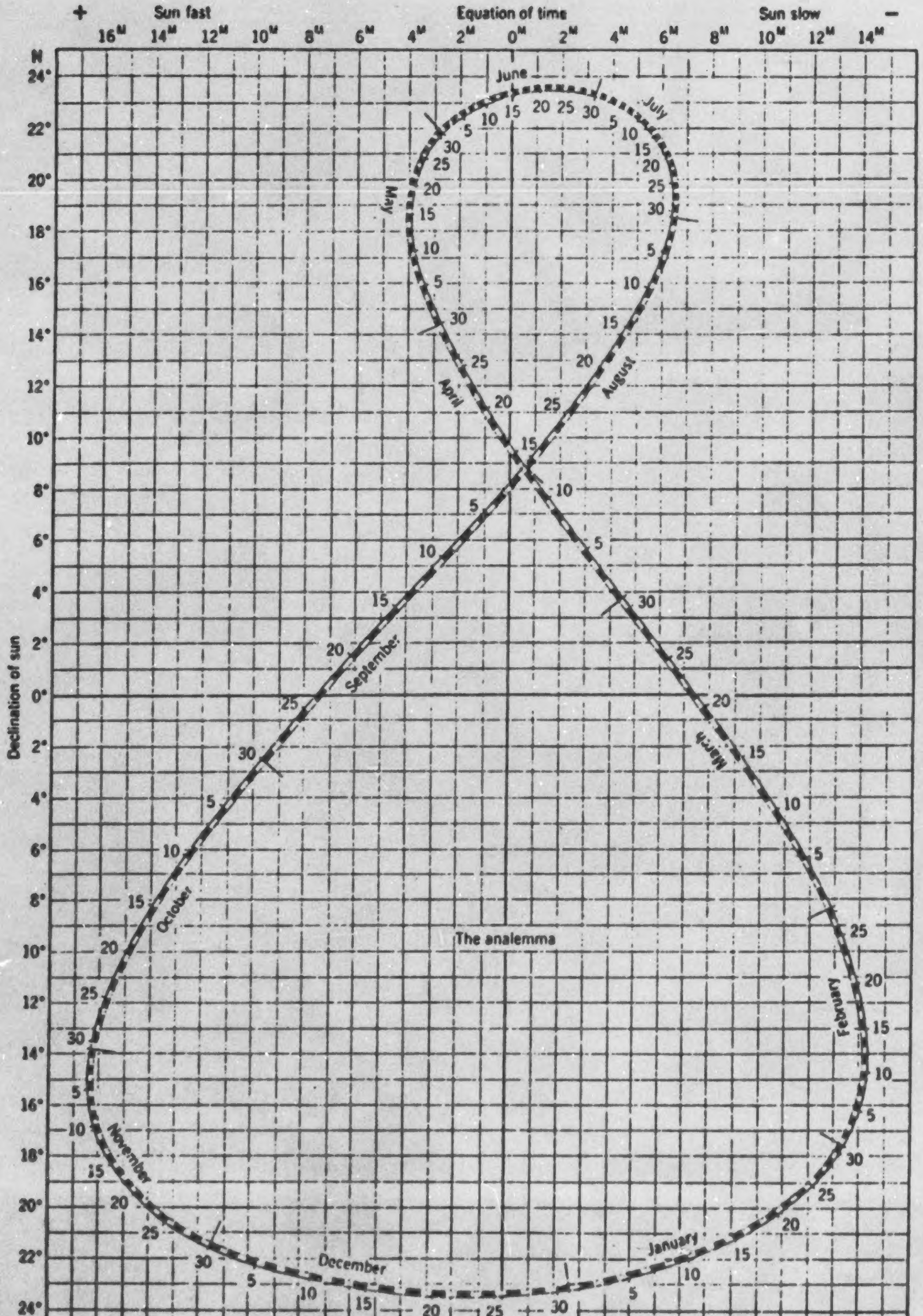
Solve: What area on the earth's surface does beam "Y" cover (see above diagram)?

Note: Use the following information to help you solve this problem:

a. appended analemma

b. formula -- $b = \frac{a. \text{ sine } B}{\text{sine } A}$

c. appended natural function conversion chart


+
Sun fast
Equation of time
Sun slow
−
16ᴹ 14ᴹ 12ᴹ 10ᴹ 8ᴹ 6ᴹ 4ᴹ 2ᴹ 0ᴹ 2ᴹ 4ᴹ 6ᴹ 8ᴹ 10ᴹ 12ᴹ 14ᴹ
N
24° 22° 20° 18° 16° 14° 12° 10° 8° 6° 4° 2° 0° 2° 4° 6° 8° 10° 12° 14° 16° 18° 20° 22° 24°
S
Declination of sun
June
July
May
April
August
September
March
October
February
November
December
January
The analemma

NATURAL CIRCULAR FUNCTIONS

°	Sine	Tang.	Cosine	Cotang.	°
0	0.0000	0.0000	1.0000	Infin.	90
1	0.0175	0.0175	0.9999	57.2900	89
2	0.0349	0.0349	0.9994	28.6363	88
3	0.0523	0.0524	0.9986	19.0811	87
4	0.0698	0.0699	0.9976	14.3007	86
5	0.0872	0.0875	0.9962	11.4301	85
6	0.1045	0.1051	0.9945	9.5144	84
7	0.1219	0.1228	0.9926	8.1444	83
8	0.1392	0.1405	0.9903	7.1154	82
9	0.1564	0.1584	0.9877	6.3138	81
10	0.1737	0.1763	0.9848	5.6713	80
11	0.1908	0.1944	0.9816	5.1446	79
12	0.2079	0.2126	0.9782	4.7046	78
13	0.2250	0.2309	0.9744	4.3315	77
14	0.2419	0.2493	0.9703	4.0108	76
15	0.2588	0.2680	0.9659	3.7321	75
16	0.2756	0.2868	0.9613	3.4874	74
17	0.2924	0.3057	0.9563	3.2709	73
18	0.3090	0.3249	0.9511	3.0777	72
19	0.3256	0.3443	0.9455	2.9042	71
20	0.3420	0.3640	0.9397	2.7475	70
21	0.3584	0.3839	0.9336	2.6051	69
22	0.3746	0.4040	0.9272	2.4751	68
23	0.3907	0.4245	0.9205	2.3559	67
24	0.4067	0.4452	0.9136	2.2460	66
25	0.4226	0.4663	0.9063	2.1445	65
26	0.4384	0.4877	0.8988	2.0503	64
27	0.4540	0.5095	0.8910	1.9626	63
28	0.4695	0.5317	0.8830	1.8807	62
29	0.4848	0.5543	0.8746	1.8041	61
30	0.5000	0.5774	0.8660	1.7321	60
31	0.5150	0.6009	0.8572	1.6643	59
32	0.5300	0.6249	0.8480	1.6003	58
33	0.5446	0.6494	0.8387	1.5399	57
34	0.5592	0.6745	0.8290	1.4826	56
35	0.5736	0.7002	0.8192	1.4282	55
36	0.5878	0.7265	0.8090	1.3764	54
37	0.6018	0.7536	0.7986	1.3270	53
38	0.6157	0.7813	0.7880	1.2799	52
39	0.6293	0.8098	0.7772	1.2349	51
40	0.6428	0.8391	0.7660	1.1918	50
41	0.6560	0.8693	0.7547	1.1504	49
42	0.6691	0.9004	0.7431	1.1106	48
43	0.6820	0.9325	0.7314	1.0724	47
44	0.6947	0.9657	0.7193	1.0355	46
45	0.7071	1.0000	0.7071	1.0000	45
°	Cosine	Cotang.	Sine	Tang.	°

Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature (under calm conditions)

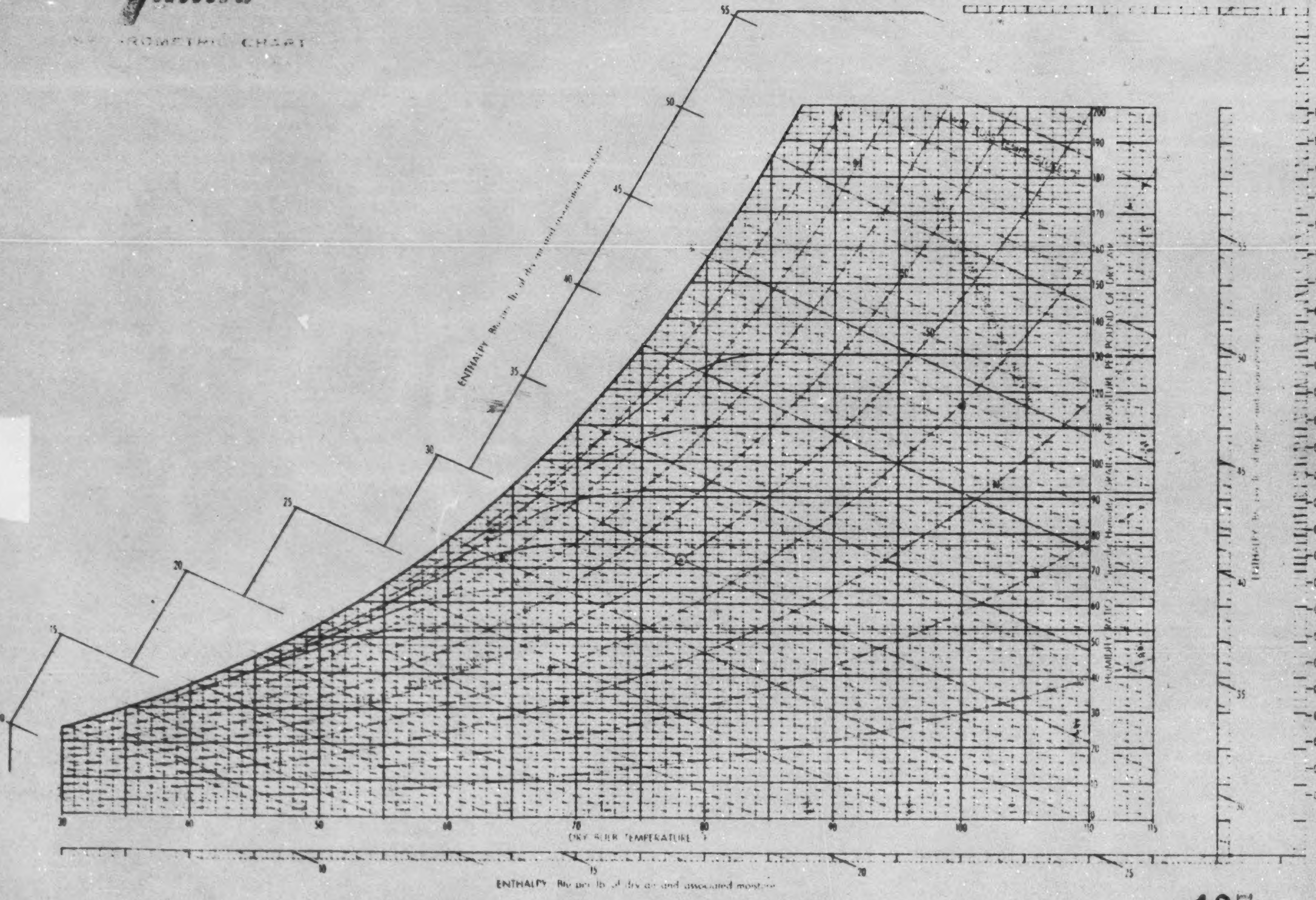
Estimated wind speed (in mph)	Actual Thermometer reading (° F.)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	EQUIVALENT TEMPERATURE (° F.)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER (for properly clothed person)				INCREASING DANGER			GREAT DANGER				
					Danger from freezing of exposed flesh							
	Trenchfoot and immersion foot may occur at any point on this chart.											

To use the chart, find the estimated or actual wind speed in the left hand column and the actual temperature in degrees F. in the top row. The equivalent temperature is found at the intersection of these two values. The description below the column indicates the danger of frostbite to exposed flesh. For example, with a wind speed of 20 mph and a temperature of +10° F, the equivalent temperature is -25° F. This lies within the zone of increasing danger of frostbite, and protective measures should be taken.

RESOURCE D

TRANE

PSYCHROMETRIC CHART



PSYCHROMETRIC TABLES

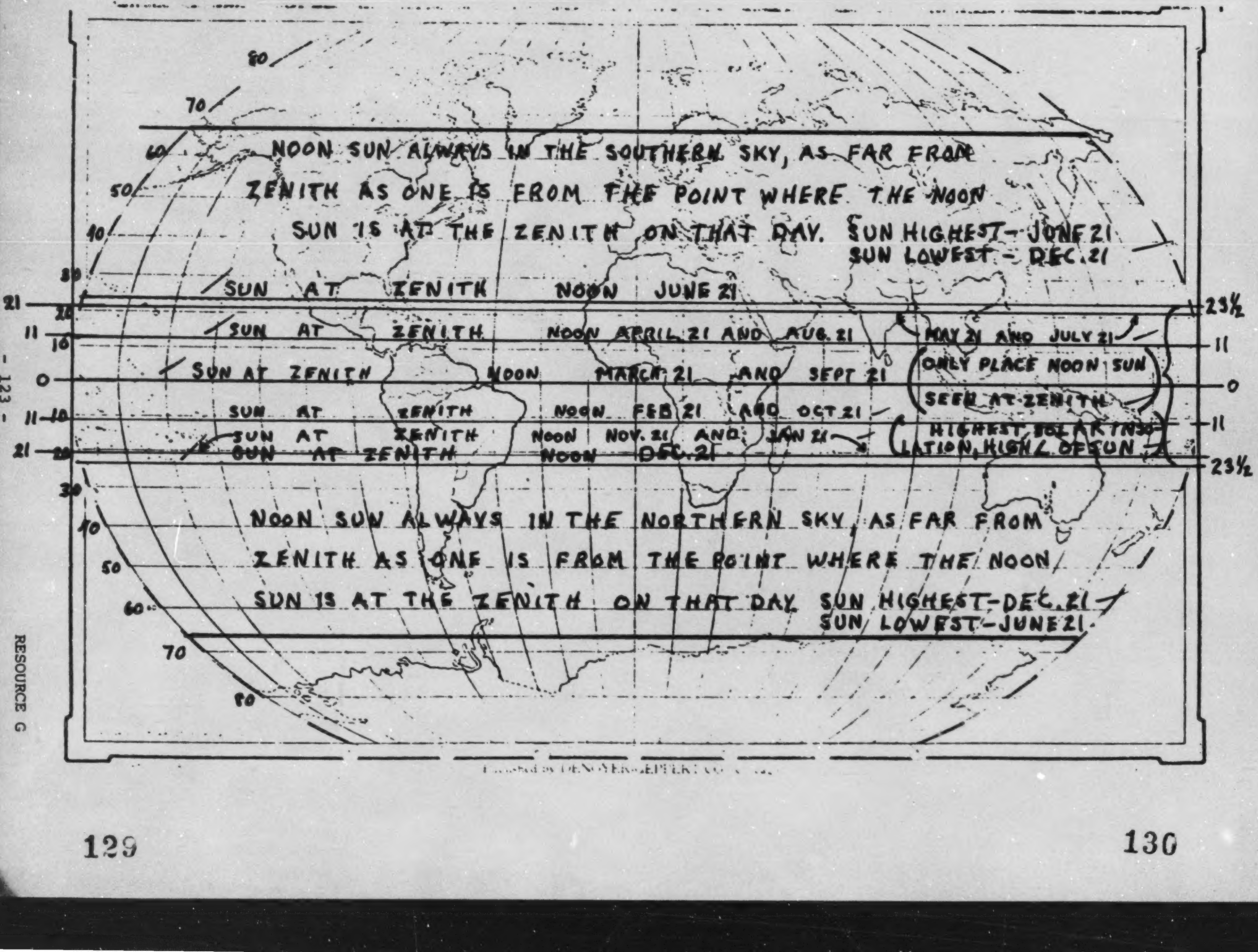
Table A. Relative Humidity, per cent. Temperatures in °F

Air Temperature	Dry Bulb Minus Wet Bulb																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0	67	33	1																											
5	73	46	20																											
10	78	56	34	13																										
15	82	64	46	29	11																									
20	85	70	55	40	26	12																								
25	87	74	62	49	37	25	13	1																						
30	89	78	67	56	46	36	26	16	6																					
35	91	81	72	63	54	45	36	27	19	10	2																			
40	92	83	75	68	60	52	45	37	29	22	15	7																		
45	93	86	78	71	64	57	51	44	38	31	25	18	12	6																
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5														
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	19	14	9	5												
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1									
65	95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	9	5	2							
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3					
75	96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	21	18	15	12	9	7	4	1		
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15	12	10	7	5	3
85	96	92	88	84	81	77	73	70	66	63	59	57	53	50	47	44	41	38	36	33	30	27	25	22	20	17	15	13	10	8
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24	22	19	17	15	13
95	96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	47	44	42	39	37	34	32	30	28	25	23	21	19	17
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30	28	26	24	22	21
105	97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	36	34	32	30	28	26	24
110	97	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	52	50	48	46	44	42	40	38	36	34	32	30	28	26
115	97	94	91	88	85	82	79	76	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38	36	34	33	31	29
120	97	94	91	88	85	82	80	77	74	72	69	67	65	62	60	58	56	53	51	49	47	45	43	41	40	38	36	34	33	31

Table B. Dew-Point Temperature, °F

Air Temperature	Vapor Pressure	Dry Bulb Minus Wet Bulb																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0	.0383	-7	-20																												
5	.0491	-1	-9	-24																											
10	.0631	5	-2	-10	-27																										
15	.0810	11	6	0	-9	-26																									
20	.103	16	12	8	2	-7	-21																								
25	.130	22	19	15	10	5	-3	-15	-51																						
30	.164	27	23	21	18	14	8	2	-7	-25																					
35	.203	33	30	28	25	21	17	13	7	0	-11	-41																			
40	.247	38	35	33	30	28	25	21	18	13	7	-1	-14																		
45	.298	43	41	38	36	34	31	28	25	22	18	13	7	-1	-14																
50	.360	48	46	44	42	40	37	34	32	29	26	22	18	13	8	0	-13														
55	.432	53	51	50	48	45	43	41	38	36	33	30	27	24	20	15	9	1	-12	-59											
60	.517	58	57	55	53	51	49	47	45	43	40	38	35	32	29	25	21	17	11	4	-8	-36									
65	.616	63	62	60	59	57	55	53	51	49	47	45	42	40	37	34	31	27	24	19	14	7	-3	-22							
70	.732	69	67	65	64	62	61	59	57	55	53	51	49	47	44	42	39	36	33	30	26	22	17	11	4	-11					
75	.866	74	72	71	69	68	66	64	63	61	59	57	55	54	51	49	47	44	42	39	36	32	29	25	21	15	8	-2	-23		
80	1.027	79	77	76	74	73	72	70	68	67	65	63	62	60	58	56	54	52	50	47	44	42	39	36	32	29	24	20	13	6	-7
85	1.201	84	82	81	80	78	77	75	74	72	71	69	68	66	64	62	61	58	57	54	52	50	48	45	42	39	36	32	28	24	19
90	1.408	89	87	86	85	83	82	81	79	78	76	75	73	72	70	69	67	65	63	61	58	57	55	53	51	48	45	43	39	34	32
95	1.645	94	93	91	90	89	87	86	85	83	82	80	79	78	76	74	73	71	70	68	66	64	62	60	58	56	54	52	49	46	43
100	1.916	99	98	96	95	94	92	91	90	89	87	86	85	83	82	80	79	77	76	74	72	71	69	67	65	63	61	59	57	55	52
105	2.225	104	103	101	100	99	98	96	95	94	93	91	90	89	87	85	84	83	82	80	78	77	75	74	72	70	68	67	65	64	61
110	2.576	109	108	106	105	104	103	102	100	99	98	97	95	94	93	91	90	89	87	86	84	83	81	80	78	77	75	73	72	70	68
115	2.975	114	113	112	111	109	108	107	106	104	103	102	101	99	98	97	96	94	93	92	90	89	87	86	84	83	81	80	78	76	75
120	3.425	119	118	117	115	114	113	112	111	110	108	107	106	105	104	102	101	100	98	97	96	94	93	92	90	89	87	86	84	83	81

RESOURCE G


80
70
60
50
40
30
21
20
11
10
0
11
10
21
20
30
40
50
60
70
80
23½
11
0
11
23½
NOON SUN ALWAYS IN THE SOUTHERN SKY, AS FAR FROM
ZENITH AS ONE IS FROM THE POINT WHERE THE NOON
SUN IS AT THE ZENITH ON THAT DAY. SUN HIGHEST - JUNE 21
SUN LOWEST - DEC. 21
SUN AT ZENITH NOON JUNE 21
SUN AT ZENITH NOON APRIL 21 AND AUG. 21
MAY 21 AND JULY 21
SUN AT ZENITH NOON MARCH 21 AND SEPT 21
ONLY PLACE NOON SUN SEEN AT ZENITH
SUN AT ZENITH NOON FEB 21 AND OCT 21
SUN AT ZENITH NOON NOV. 21 AND JAN 21
HIGHEST SOLAR INSOLATION, HIGH L OF SUN
SUN AT ZENITH NOON DEC. 21
NOON SUN ALWAYS IN THE NORTHERN SKY, AS FAR FROM
ZENITH AS ONE IS FROM THE POINT WHERE THE NOON
SUN IS AT THE ZENITH ON THAT DAY SUN HIGHEST - DEC. 21
SUN LOWEST - JUNE 21.

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WEATHER MODULE EXAM

1. Name and briefly define the three factors responsible for the cycle of seasons we experience on earth. Next to each of the four "earths" in the following figure, write what season it is in the Northern Hemisphere.

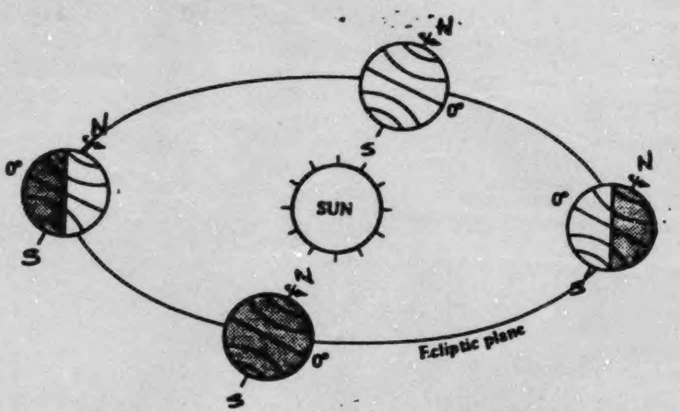


Figure 3.11 *The revolution of the earth about the sun, illustrating the changing length of day.*

2. What is insolation? What five factors determine this quantity?

3. Find the altitude (angle of incidence) of the noon sun for: (hint: use your analemma)
    a. South Bend, Indiana (41^{O}NL) on July 24
    b. Sydney, Australia (35^{O}SL) on October 2

4.

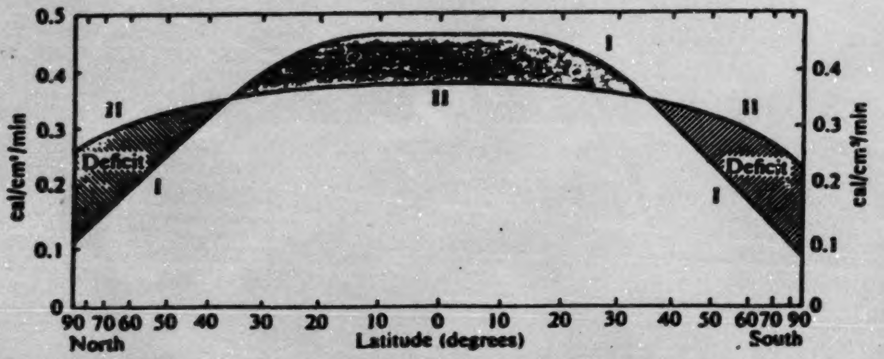


Figure 3.13 ***Mean annual radiation absorbed (curve I) and emitted (curve II) by the earth and its atmosphere.***

Explain the meaning of this graph as it applies to the earth's energy balance and global energy transfer.

5. Referring to the following diagram, at which latitudes would you expect the greatest amount of cloudiness and precipitation? the least? Explain your answers.

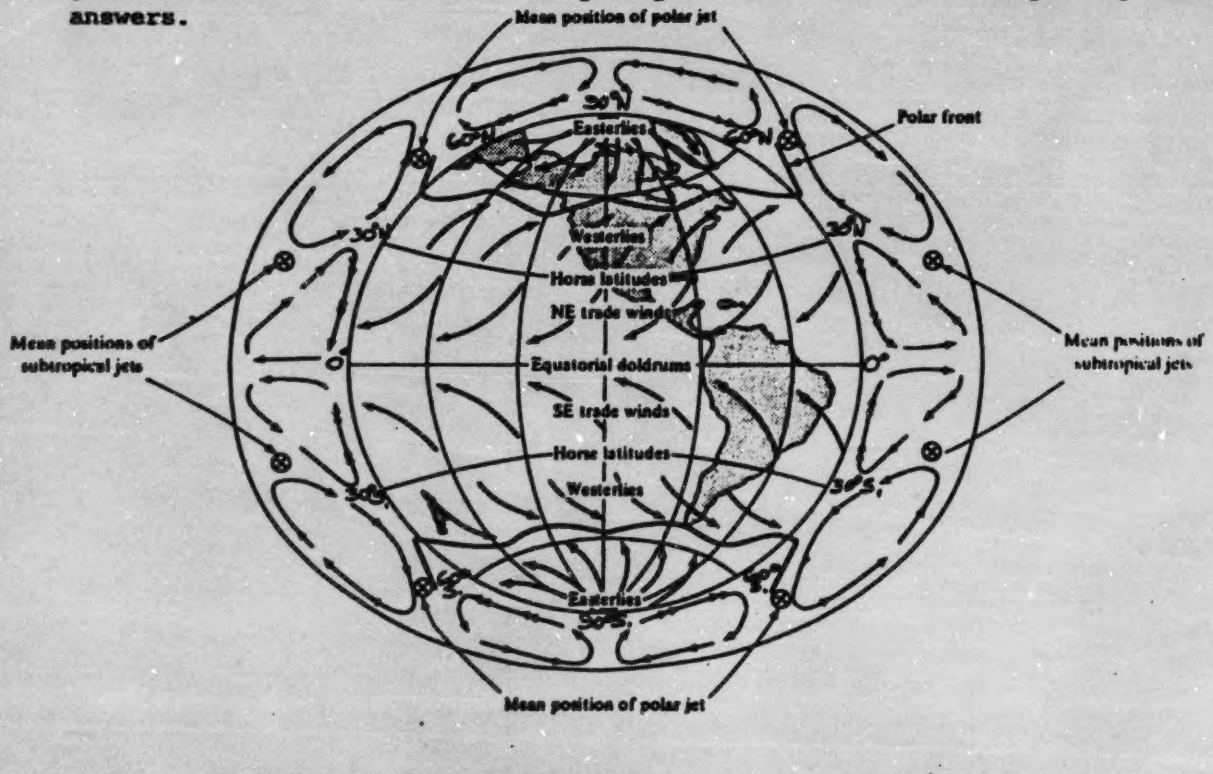

Mean position of polar jet
90°N
60°N
Polar front
Easterlies
Westerlies
30°N
Horse latitudes
NE trade winds
Mean positions of subtropical jets
Equatorial doldrums
0°
SE trade winds
Horse latitudes
Westerlies
30°S
60°S
Easterlies
90°S
Mean position of polar jet

Figure 5.1 ***Schematic representation of the general circulation of the atmosphere. Double-headed arrows in cross section indicate wind component from the east.***

6. What is an air mass? Name the four general types of air masses and their characteristics.

7. For the following diagram, give the name of each change-of-state process (a. thru f.) and tell whether heat is released or absorbed.

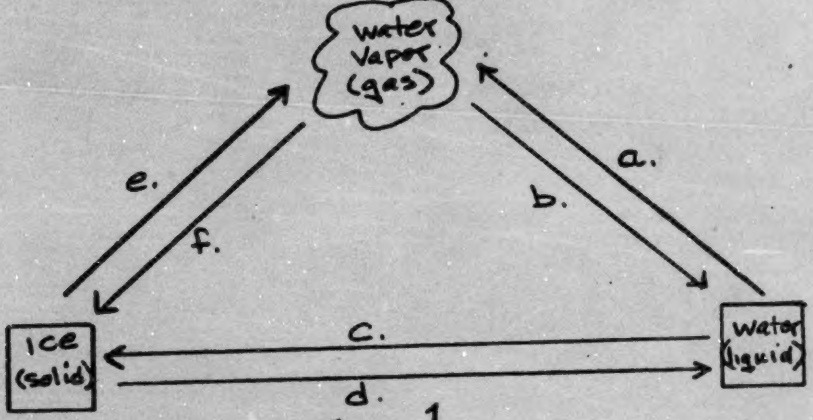


Fig. 1

a.
b.
c.
d.
e.
f.

8. Given: dry bulb temperature = $82^{\circ}F$
relative humidity = 65%
Find the temperature-humidity index in three different ways. (hint: use your psychrometric chart). For whom are these conditions comfortable?

9. Name the four factors responsible for human comfort.

Helpful formulas: (1) Altitude = 90 - (given latitude-declination of the sun)
(2) $T.H.I. = 0.4\ (DB+WB)+15$
(3) $T.H.I. = 0.55\ (DB) + 0.2\ (DP) + 17.5$
(4) $T.H.I. = DB - [0.55-0.55(RH)]\ (DB-58)$
(5) $M = E \pm R \pm C$

COST CALCULATIONS

The following materials are used to meet the Cost Calculations module objectives in Volume i (p. 62).

Objective	Resource
1	ASHRAE Handbook - Systems volume - Estimating Annual Fuel Consumption.
1	Sample problems
2	Handouts on Payback and Return on Investment Resource A.
2	Sample problems
3	Handout on Billing Audit Procedures Resource B
3	Sample problems
4	Lecture and sample problems
5	ASHRAE Handbook - Systems volume - Materials on Hot Water.
5	Handouts on Rates for Gas Service, from local gas company.
Evaluation	Exam - Resource C

SELLING BY ROI

Energy conserving controls are sold on the basis of return on investment or ROI.

While businessmen, like all Americans, feel some moral obligation to save energy, they must also be able to justify business expenditures. Money spent on energy conservation can be economically justified.

Money spent on energy saving devices with pay back periods under five years is an excellent business investment. It is the same as investing money at more than 20% interest. A pay back period of two years is like investing money at 50% interest, one year is like getting 100% interest on your money.

Most of the controls included in this manual have pay back periods much better than five years. Here are some examples:

1. Economizers - less than 1 year to 3 years.
2. Electronic Single Zone Systems - 1 year to 4 years.
3. Radiator Valves - 2-1/2 years to 3-1/2 years.
4. Chronotherm - under three years. About one year if cooling set-up savings are added.
5. Demand defrost controller - 1 to 3 years.

Customers will buy energy management controls, if --

- they understand that they are investing their money and not spending it.
- they are confident that the amount of savings we are projecting is correct.
- they realize that energy costs will continue to climb, so that an investment in energy conservation made now will increase in value in the future.

The key, then, to selling energy management controls is to help the customer clarify his need to reduce his cost for energy, to show him how much he will save compared to his required investment, and to show him that his return on investment will grow as energy rates continue to climb.

BROAD INDICATORS

There are two so called "broad" indicators for determining whether a capital investment to reduce energy consumption is a profitable investment. These are payback period and return on investment.

Both of these indicators are calculated from two factors - the cost of the improvement, and the annual savings.

Annual savings is calculated by multiplying the amount of energy saved each year by the local rate for that energy. So you must determine these two pieces of information - energy saved and local rates. Energy saved can in some cases be estimated from the information in the energy management binder. Or, it may be determined by monitoring an actual field application. (We will look more later at how this technique can be used to get sales.) Local utility rates can be determined. (We'll also look at how you can do that.)

System cost, of course, must be determined for each specific system.

PAY BACK PERIOD

Payback period is a simple indication of how long it will take to recover the cost of an energy improvement as a result of the energy savings. Mathematically, it is simply equal to the cost of the improvement divided by the average annual savings.

$$\text{Payback period} = \frac{\text{Cost (of the improvement)}}{\text{Average Annual savings (in dollars)}}$$

In other words, if the expected life of the improvement is ten years, then the estimated annual savings should include the potential rise and energy costs over those ten years.

Here's an example.

An economizer is to be applied to a ten ton rooftop unit in the Southwest. Projected savings for the area involved are anticipated at $21 per ton, based on 13 hours per day occupancy. (These projected savings are obtained from the energy management manual). We can assume very conservatively that energy costs will probably go up more than 100% during the 10 year period. The average annual saving then might be $30 per ton, times 10 tons, or $300 per year.

Assume an installed cost of $600. Then -

$$\text{Payback Period} = \frac{\text{Cost of \$600}}{\text{Annual Savings of \$300}} = 2 \text{ years.}$$

Because the payback period is so short in the case of economizer type controls, we can afford to be ultra conservative and use a "rough" payback period which ignores the probable increase in fuel cost. In this case -

$$\text{Payback period} = \frac{\text{Cost at \$600}}{\text{Immediate Annual Savings of \$200}} = 3 \text{ years.}$$

A rule of thumb is that a payback period less than half the expected life of the improvment will be profitable.

RETURN ON INVESTMENT

A return on investment calculation should take into account the depreciation of the investment over its life, or mathematically -

$$\text{ROI (in percent)} = \frac{\text{Average Annual Savings} - \text{Annual Depreciation}}{\text{Cost}} \times 100\%$$

Here again, however, it is normally satisfactory to calculate a rough return by ignoring both the fact that energy costs will increase, and that the capital investment will depreciate. This gives us -

$$\text{ROI (rough)} = \frac{\text{Immediate Annual Savings}}{\text{Cost}} \times 100\%$$

Using the figures from our previous economizer example -

$$\text{ROI (rough)} = \frac{210}{600} \times 100\% = 35\%$$

For an improvement to be economically justifiable, the ROI must be greater than the value of money if it were applied in some other way. If a customer feels, for example, that his capital used internally is worth 20%, then the return on any type of outside investment must be greater than 20%.

HOW TO APPLY THE ROI TECHNIQUE

To make effective use of the ROI selling technique, some planning, or "homework" is required.

1. Become familiar with the product. Determine from the Energy Management Manual how much energy a control or control system will save under typical conditions. Note that this varies from geographic area to area. Find the savings for your area.
2. Check local energy costs.
   - For natural gas, call the local gas company consumer office.
   - For heating oil, call a local fuel oil dealer.
   - For electric rates, call the electric utility consumer office and inquire. You may determine the general residential rate. You may also ask for and receive the rates for specific commercial structures.

You may also obtain a publication from the government printing office entitled, National Electrical Rate Book for (name of state). This publication is prepared by the Federal Power Commission. It is available for every state. It includes rate schedules for residential, commercial, and industrial electric service in communities of 2500 population or more.

The book is available from the Superintendent of Documents, U.S. Government Printing office, Washington, D.C. 20402.

3. Determine local energy trends. An important part of your ROI story is the fact that energy costs have risen dramatically and will continue to rise. Typical projections for rising energy costs are contained in the introductory section of the Energy Management Manual. You will, however, want to determine local conditions. Important questions to consider include:
   - What is the local dependence on natural gas? What affect will it have on space heating and electric rates when natural gas prices are deregulated?
   - What is the local dependence on imported oil?
   - How close are plentiful coal supplies for utilities?
   - Are there other important factors, such as a pending rate increase, a local or state plan to restructure electric rates, a threatened cutoff of an existing fuel source (such as Canadian oil to the Northern and New England states)?

Remember, any increase in energy costs has a direct impact on ROI, so you will want to be sure your customer is aware of potential increases.

MORE DETAILED FINANCIAL INDICATORS

We mentioned that the two broad indicators, payback period and return on investment, do not take into account the probable increase in the value of the capital invested if it were invested elsewhere. We have even suggested that in most cases it is satisfactory to ignore other factors as well - including depreciation and detailed projections of energy cost increases.

The degree of detailed financial analysis required is certainly related to how close an improvement is to being profitable to the company which applies it. In other words, an improvement that is unquestionably profitable does not require as detailed an analysis as one that is borderline.

Improvements we are looking at in this manual are unquestionably profitable to the owner. Returns on investment are in the range of 30% to over 100%. Because the return is so high, a rough calculation of the return is generally sufficient.

There may be, however, be occasions when you will need more detailed indicators.

More detailed, or "second level" economic indicators for studying the profitability of an energy management improvement include Benefit/Cost analysis, and Break-Even Point analysis.

Second level measures of performance incorporate an allowance for the time value of money, generally in the form of a discount factor. Because of alternative investment opportunities, a dollar held today is worth more than a dollar held in some future time period. The internal rate of return on the best available investment alternative is generally considered to be the appropriate discount rate for evaluating new investment opportunities, unless this rate is below the true borrowing rate when a new investment needs to be financed. In this case, the discount rate must be at least as high as the borrowing rate.

While appropriate discount rates may differ widely in different industries and even among firms within the same industry, discount rates usually run between 10 to 20% or higher. This, again, is equivalent to saying that such a return can be realized elsewhere and thus for a new investment to be justified it must yield a return somewhat greater than this. It should be noted that profits generated by energy savings are generally taxed at the same rate as profits earned elsewhere within or outside of the firm, affirming the need for an equivalent discount rate for energy saving projects.

Benefit/Cost analysis requires the direct comparison of the present value benefits (savings) generated by a given investment with its costs. Generally this is formulated in terms of a Benefit/Cost ratio (B/C). A ratio greater than unity implies that the expected net benefits (properly discounted and summed over the lifetime of the investment) will exceed the initial costs and therefore such an investment is profitable. Likewise, a benefit/cost ratio less than unity implies that such an investment is not profitable. As an absolute measure of the profitability of an investment this is generally considered superior to all others.

The benefits, or net savings, when constant in each time period, can be expressed in terms of their present value by using a discount rate and summing the benefits over the expected lifetime of the project. The present value can be easily estimated using the present worth factors in Table 1. By finding the appropriate factor for the discount rate and expected lifetime (EL) of the investment and multiplying the factor by the net annual savings, the present value of the future savings can be determined. If this present value is greater than the first cost of the investment, the project is profitable. Refer to the example which follows.

The "Break-even" Period, or the Time to Recoup Capital Investment, is similar in concept to the Payback Period discussed earlier, except that the Break-even period takes discount rates into consideration. This measurement of performance is often useful to financial planners and budget analysis.

The Break-even Period can be quickly approximated using Table 1. Locate in the column for the appropriate discount rate the present worth factor on either side of the payback period calculated as shown previously. The break-even period will be between these two years; interpolation will allow a closer approximation. Refer to the following example.

EXAMPLE

The following example shows the Payback Period, ROI, Benefit/Cost analysis, and Breakeven Point analysis for the following energy saving improvement.

Cost - $30,000

Annual Fuel Savings - $10,000 not including projected increases; $15,000 including projected increases.

Expected life - 10 years.

PAYBACK PERIOD

$$\text{Payback Period} = \frac{\text{Cost}}{\text{Average Annual Savings}} = \frac{30{,}000}{15{,}000} = 2 \text{ yrs.}$$

ROI (rough)

$$\text{ROI (rough)} = \frac{\text{present annual savings}}{\text{cost}} \times 100\%$$

$$= \frac{10{,}000}{30{,}000} \times 100\% = 33\%$$

ROI

$$\text{ROI} = \frac{\text{Avg. Annual Saving-Annual Depreciation}}{\text{Cost}} \times 100\%$$

$$= \frac{15{,}000-3000}{30{,}000} \times 100 = 40\%$$

TABLE 1

PRESENT WORTH FACTORS (PWF)

LIFETIME (EL)	DISCOUNT RATE (D)				
	5%	10%	15%	20%	25%
1	0.952	0.909	0.870	0.833	0.800
2	1.859	1.736	1.626	1.528	1.440
3	2.723	2.487	2.283	2.106	1.952
4	3.546	3.170	2.855	2.589	2.362
5	4.329	3.791	3.352	2.991	2.689
6	5.076	4.355	3.784	3.326	2.951
7	5.786	4.868	4.160	3.605	3.161
8	6.463	5.335	4.487	3.837	3.329
9	7.108	5.759	4.772	4.031	3.463
10	7.722	6.145	5.019	4.192	3.571
11	8.306	6.495	5.234	4.327	3.656
12	8.863	6.814	5.421	4.439	3.725
13	9.394	7.103	5.583	4.533	3.780
14	9.899	7.367	5.724	4.611	3.824
15	10.380	7.606	5.847	4.675	3.859
16	10.838	7.824	5.954	4.730	3.887
17	11.274	8.022	6.047	4.775	3.910
18	11.690	8.201	6.128	4.812	3.928
19	12.085	8.365	6.198	4.843	3.942
20	12.462	8.514	6.259	4.870	3.954
21	12.821	8.649	6.312	4.891	3.963
22	13.163	8.772	6.359	4.909	3.970
23	13.489	8.883	6.399	4.925	3.976
24	13.799	8.985	6.434	4.937	3.981
25	14.094	9.077	6.464	4.948	3.985

BENEFIT/COST RATIO ANALYSIS

Assume discount rate of 20% (company feels internal use of capital is worth 20%/yr).

Present worth factor (from table) is 4.192.

Present value equals annual saving x present worth factor or $15000 x 4.192 = $63,000.

$$\text{Benefit cost ratio} = \frac{\text{Present value}}{\text{cost}} = \frac{63,000}{30,000} - 2.1$$

BREAKEVEN POINT ANALYSIS

Time to Recoup Investment can be quickly approximated by using Table 1 and the payback period estimated earlier as 2 years. In the 20% discount rate column one can find that the present worth factor closest to 2 is 2.106 which indicates that the investment will be entirely recouped in about 3 years when taking the time value of money into consideration. While this is longer than the payback period without discounting, it provides a much better indication of the profitability of this investment because it includes the cost of foregone investment opportunities. If the proper discount rate has been used any investment which is recouped in a period less than its lifetime should be considered profitable.

SUMMARY

There are a number of indicators of profitability of an energy conserving investment.

In general the rough ROI calculated from cost and present fuel savings is satisfactory for investments with returns as high as those we are looking at here.

While this figure does not allow for the value of the capital invested elsewhere, it also does not account for the projected increase in energy costs which will more than offset this.

COST CALCULATIONS

II. Billing Audit - Actual Energy Consumption

A. Convert and tabulate billing data (consumption and cost figures) to monthly form.

1. For continuously supplied fuel (e.g., piped natural gas, electricity, purchased steam, etc.) use the following formula:

$$E_n = \frac{C_n \times B_n}{(B_n + N_{n-1} - B_{n-1})^*} + \frac{C_{n+1} \times (N_n - B_n)}{(B_{n+1} + N_n - B_n)^*}$$

Where:

E_n = fuel consumption (or cost) for desired month n
n = desired month
$n-1$ = previous month
$n+1$ = following month
N_n = number of days in month n
N_{n-1} = number of days in month n-1
B_n = Billing (meter reading) date for month n
B_{n-1} = Billing (meter reading) date for month n-1
B_{n+1} = Billing (meter reading) date for month n+1
C_n = Fuel consumption (or cost) for billing period between dates B_{n-1} and B_n (or consumption (or cost) for first billing period containing part of E_n)
C_{n+1} = fuel consumption (or cost) for billing period between dates B_n and B_{n+1} (or consumption (or cost) for second billing period containing part of E_n)

*Note: $(B_n + N_n - B_{n-1})$ = number of days in billing period for C_n

$(B_{n+1} + N_n - B_n)$ = number of days in billing period for C_{n+1}

2. For intermittently supplied, stored fuels (e.g., oil, coal, wood, LP gas, etc):
   a. Sum up total of all fuel deliveries (and costs) over the specified consumption period. (Be sure to subtract the first delivery in the period since this figure represents fuel used before the tank was filled.)

   b. Divide by total of monthly heating degree days in the same period to obtain appropriate fuel units consumed (or cost) per degree-day (e.g., gals/degree-day, $/degree day)

   c. Then multiply the answer(s) from b. by the number of heating degree days per month to obtain appropriate fuel units (or cost) per month (e.g., gals/month, $/month)

3. Divide monthly fuel consumption by the appropriate fuel factor (FF, from I.A.2. above) to obtain monthly energy consumptions in Therms/month.

II. Billing Audit - Actual Energy Consumption (cont.)

B. Make a graph for each fuel used showing:
   1. Monthly fuel consumption vs. months.
   2. Monthly costs vs. months.
   3. Heating degree days (base $65^{0}F$) vs. months (for the fuel used by the heating system).
   4. Cooling degree-days (base 65^{0}) vs. months (for the fuel used by the cooling system, usually electricity).

C. Sum up monthly totals in A. above for each complete year of data available for each fuel used to obtain actual values for all systems:
   1. Total annual fuel consumption, in appropriate fuel units per year.
   2. Total annual energy consumption, in Therms/year.
   3. Total annual costs, in dollars/year.

D. Separate space conditioning inputs from base loads (energy used for purposes other than space heating or cooling) for each fuel (± 10% accuracy)
   1. a. For fuel used by heating systems:
         Take the monthly fuel consumption figures for the 5 months of lowest space heating consumption (i.e., May thru September) from II.A. above.
      b. For fuel used by cooling system (usually electricity):
         Take the monthly fuel consumption figures (from II.A. above) for the 5 months of lowest space cooling consumption (i.e. Nov. thru March.

   2. Exclude the highest and lowest of the five monthly figures

   3. Sum the remaining three monthly figures and divide by 3 to obtain average monthly base loads for each fuel (Note: If more than one set of May thru Sept. or Nov. thru March figures are available from past bills calculate as many base load figures as possible from the figures available and then use the average of those. The more figures available, the greater the accuracy of the calculation).

   4. Multiply the monthly average base loads by 12 months/yr. to obtain average annual base loads, in appropriate fuel units per year for each fuel used.

   5. Subtract the base load from II.D.4 from the total fuel consumption in II.C.1 for the appropriate fuel to obtain:
      a. Annual heating system fuel consumption, in appropriate units/yr.
      b. Annual cooling system fuel (electricity) consumtion, Kwh/yr.

   6. To correct for the effects of unusually warm or cold weather, multiply the answers from II.D.5.a. and b. by:

      a. No. of heating degree days (base $65^{o}F$) ÷ 6440 for heating system
      b. No. of cooling degree days (base $65^{o}F$) ÷ 715 for cooling system

These answers will represent the heating or cooling system's consumption during a "normal" (average) year.

II. Billing Audit - Actual Energy Consumption (cont.)

E. Determine approximate efficiencies of each system
  1. Divide estimated fuel consumption by actual fuel consumption
    a. Heating System - I.A.2. ÷ II.D.6.a.
    b. Cooling System - I.B.2. ÷ II.D.6.b.
    c. Hot Water System - I.C.3. ÷ _______
  2. Multiply the answers from II.E.1. by:
    a. 0.75 for gas or oil heating system
       1.3 for electric resistance system
    b. EER (cooling capacity in btu/hr ÷ equipment power rating, watts) for electric cooling system.
    c. 0.6 for noncirculating gas or oil hot water system
       0.9 for noncirculating electric hot water system
    Efficiencies from I.C.3. for circulating hot water systems

These answers are descriptions of the actual performance of each system compared to our estimations.

PAYBACK PERIOD AND RETURN ON INVESTMENT

EXAM

Calculate Payback Period and Return on Investment for the following two problems:
(set up the problems and show your work on the exam paper)

1) Appliance cost $438 with an annual savings of $209.27.

2) Given:

Initial cost of energy-saving improvement = $500.00
Annual energy saved = 200 therms.
Assumed fuel prices:
electricity = $.05/KWH
natural gas = $.25/CCF
fuel oil = $.60/gal.

Problem: For each of three fuels, calculate the following -

1) annual dollar savings,
2) payback period, and
3) return on investment.

Determining Monthly Oil Consumption and Cost During a Single Heating Season (July 1976 - June, 1977)

Given:

Fill-up date	gallons	cost
7/1/76	180	71.98
11/16/76	134	54.97
12/21/76	166	69.47
1/17/77	196	84.73
2/14/77	159	74.19
6/30/77	185	82.38

Problem: Fill in the following table (show calculations on back of sheet)

Monthly Distribution of Therms and Cost

Date	Degree Days	Therms	Cost
July, 1976	0		
August, 1976	19		
Sept., 1976	139		
October, 1976	525		
Nov., 1976	949		
Dec., 1976	1302		
Jan., 1977	1628		
Feb., 1977	1063		
March, 1977	640		
April, 1977	327		
May, 1977	85		
June, 1977	68		

Energy Efficiency Ratios and Coefficients of Performance

Calculate E.E.R.'s and C.O.P's for the two pieces of refrigeration equipment (set-up your problems and show all work on back of exam paper)

Given:

Unit A: Initial cost - $473
size - 10,000 btu/h
watts - 1427
cooling output - 53 btu/lb.
compressor input - 9.3 btu/lb.

Unit B: Initial cost - $532
size - 10,000 btu/h
watts - 880
cooling output - 59 btu/lb.
compressor input - 7.9 btu/lb.

Assuming these two refrigeration units have a seasonal operating time of 850 hours, use Life Cycle Costing Analysis to show which of the two units is cheaper over a fifteen year life expectancy (use average cost over period of $.05/KWH).

HEAT-LOSS CALCULATIONS

The following pages are taken from "modified" Retrotech.
There are 4 basic functions to perform:

1) Calculate infiltration,
2) Calculate ceiling heat loss,
3) Calculate wall heat loss, and
4) Calculate "pay-off" time on adding 3½" of cellulose to walls and 6" of cellulose to the ceiling.
(Fill in all blank spaces on the worksheets)

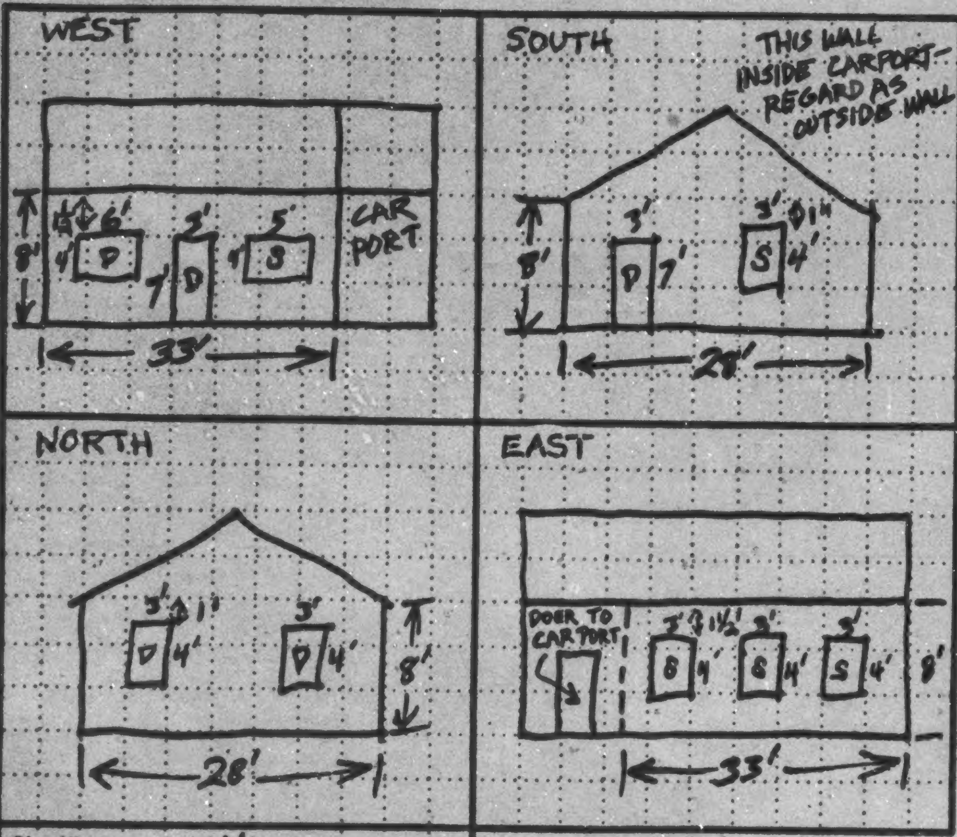
Given:

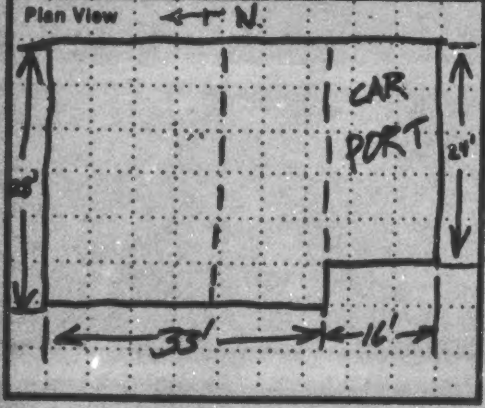
1) Use all the given house dimensions on the description of building page.
2) Use the best material cost figures you have in your notes.
3) Note all modifications to Retrotech (e.g., air changes per hour on infiltration page)
4) Assume that cellulose will give you an R=3.7/inch

Sketch all views and put dimensions on each part shown, for example, length of walls, width and length of windows, etc. Label all single glass windows S and double glass and doors D. Complete all items in the job book labeled "Fill in at Job Site."

Description of Building

- Dark Roof
- 2 Bedrooms
- Full Basement
- Ducts in Conditioned Space
- Shading: W- Draperies All others - Roller shades
- 2 ft. Overhang Roof E&W sides
- Naturally vented attic


WEST
1'
6'
3'
5'
CAR PORT
8'
4'
D
7'
D
4'
S
33'
SOUTH
THIS WALL INSIDE CARPORT-REGARD AS OUTSIDE WALL
3'
3'
1"
8'
D
7'
S
4'
28'
NORTH
3'
1"
3'
D
4'
D
4'
8'
28'
EAST
DOOR TO CARPORT
3'
1½'
3'
3'
S
4'
S
4'
S
4'
8'
33'


Plan View
N.
CAR PORT
28'
24'
33'
16'

Calculation of Floor Area

33 Building length ft. x 28 Building width ft.

= 924 Floor area sq.ft.

These grids are provided as guides for lines. Drawings need not be done to scale.

Project RetroTech

Home Weatherization
Job Book

n pages 4-9, calculate the heat loss by filtration and by conduction through the eparate parts of the building; enter the results in the table at the bottom of each page and in the summary table on page 10.

House Draft Index: Opposite each of the four component parts of a building in the table below, place a check mark in the circle adjacent to the features which best describe the condition of the building.

Heat L
by Infiltration

Building Component	.5 Air change per hour ①		1 Air change per hour ②		2 Air change per hour ③	
Cellar or Crawl Space	Tight, no cracks, caulked sills, sealed cellar windows, no grade entrance leaks Plywood floor, no trap door leaks, no leaks around water, sewer, and electrical openings	☑	Some foundation cracks, loose cellar windows, grade entrance not tight Tongue-and-groove board floor, reasonable fit on trap doors, around pipes	○	Major foundation cracks, poor seal around grade entrance Board floor, loose fit around pipes	○
Windows	Storm windows with good fit	☑	No storm windows, good fit on regular windows	○	No storm windows, loose fit on regular windows	○
Doors	Good fit on storm doors	☑	Loose storm doors, poor fit on inside door	○	No storm doors, loose fit on inside door	○
Walls	Caulked windows and doors, building paper used under siding	☑	Caulking in poor repair, building needs paint	○	No indication of building paper, evident cracks around door and window frame	○

FILL IN AT JOB SITE

ultiply the number of check marks in the first column by .5 the second column by 1, and the third column by 2. The Draft Index will be the sum of these products, divided by 4.

☐ Floor area sq.ft. x ☐ Height to ceiling (to upstairs ceiling in two-story house) ft. = ☐ Volume of air in building cu.ft.

☐ olume of air building x ☐ Draft index x 1.54 District heating factor x .018 = ☐ Heating units required

otential Savings by Reducing Infiltration

should be possible to reduce the draft index r a building to 1 (that is, reduce the number of air changes to one per hour). If the draft index for this building were improved to 1, the infiltration loss would be:

☐ olume (from above) x .5 Draft index x 1.54 District heating factor x .018 = ☐ Potential heating units

ubtract the potential heating units from those ow required and enter here ⟶

Type of Heat Loss	Heating Units Required	Potential Heating Savings	Proposed Changes to Structure
Infiltration			none

RESOURCE C

Heat L[illegible]
by Infil[illegible]tion

n pages 4-9, calculate the heat loss by filtration and by conduction through the parate parts of the building; enter the results in the table at the bottom of each page and iq the summary table on page 10.

House Draft Index: Opposite each of the four component parts of a building in the table below, place a check mark in the circle adjacent to the features which best describe the condition of the building.

Building Component	.5 Air change per hour ①		1 Air change per hour ②		2 Air change per hour ③	
Cellar or Crawl Space	Tight, no cracks, caulked sills, sealed cellar windows, no grade entrance leaks Plywood floor, no trap door leaks, no leaks around water, sewer, and electrical openings	☑	Some foundation cracks, loose cellar windows, grade entrance not tight Tongue-and-groove board floor, reasonable fit on trap doors, around pipes	○	Major foundation cracks, poor seal around grade entrance Board floor, loose fit around pipes	○
Windows	Storm windows with good fit	☑	No storm windows, good fit on regular windows	○	No storm windows, loose fit on regular windows	○
Doors	Good fit on storm doors	☑	Loose storm doors, poor fit on inside door	○	No storm doors, loose fit on inside door	○
Walls	Caulked windows and doors, building paper used under siding	☑	Caulking in poor repair, building needs paint	○	No indication of building paper, evident cracks around door and window frame	○

FILL IN AT JOB SITE

ultiply the number of check marks in the first column by .5 the second column by 1, and the third column by 2. The Draft index will be the sum of these products, divided by 4.

Floor area sq.ft.	x	Height to ceiling (to upstairs ceiling in two-story house) ft.	=	Volume of air in building cu.ft.
	x		=	

olume of air in building	x	Draft index	x	District heating factor		=	Heating units required
	x		x	1.54	x .018	=	

otential Savings by Reducing Infiltration

should be possible to reduce the draft index r a building to 1 (that is, reduce the number of air changes to one per hour). If the draft index for this building were improved to 1, the infiltration loss would be:

olume (from above)	x	Draft index	x	District heating factor		=	Potential heating units
	x	.5	x	1.54	x .018	=	

ubtract the potential heating units from those ow required and enter here →

Type of Heat Loss	Heating Units Required	Potential Heating Savings	Proposed Changes to Structure
Infiltration			none

Heat Losses by Conduction Through Ceilings

Area of Ceiling
(Take area of upstairs ceiling in a two-story house)

Ceiling area will normally be the same as floor area (from building description sheet)

Material	Thickness (Inches)	R Value
Inside surface	–	0.61
Gypsum Bd.	3/8	0.32
Fiber Bd.	2	7.4
Inside surface — OR — Outside surface (0.17)	– –	0.61
	Total R value	

16"
Distance between joists/rafters:

FILL IN AT JOB SITE

☐ Ceiling area sq.ft. × 1.54 District heating factor ÷ ☐ Total R value = ☐ Heating units required

Potential Savings by Insulation of Ceilings

A well-insulated ceiling (with 6 inches of insulation) should have an R value of 20. If the R value were 20 for this building, the ceiling heat loss would be:

☐ Ceiling area sq.ft. × 1.54 District heating factor ÷ 20 Total R value = ☐ Potential heating units

Subtract the potential heating units from those now required and enter here

Type of Heat Loss	Heating Units Required	Potential Heating Savings	Proposed Changes to Structure
Conduction Through Ceilings			add 6" cellulose

RESOURCE C

Heat Losses by Conduction Through Walls

R Value of Outside Walls

List below all materials in walls, starting from inside and including air spaces within the wall. Insert R value for each component from Table 1.

Material	Thickness (Inches)	R Value
Interior surface	—	0.68
plaster + lath	3/4"	.42
air space	3½"	.91
ship-lap	1/2"	1.05
alum. siding		.77
Outside surface	—	.17
	Total R value	

FILL IN AT JOB SITE

☐ Total perimeter of outside wall ft. × ☐ Total height of outside wall ft. = ☐ Gross wall area sq.ft

☐ Gross wall area sq.ft − ☐ Total area of all windows and doors (from previous two pages) sq.ft. = ☐ Net wall area sq.ft.

☐ Net wall area × 1.54 District heating factor ÷ ☐ Total R Value = ☐ Heating units required

Potential Savings by Insulation

Well-insulated walls should have an R value of 15. If this were so for this building, the wall heat loss would be:

☐ Net wall area (from box above) × 1.54 District heating factor ÷ 15 R value = ☐ Potential heating units

Subtract the potential heating units from those now required and enter here →

159

Type of Heat Loss	Heating Units Required	Potential Heating Savings	Proposed Changes to Structure
Conduction Through Walls			add 3½" cellulose

Job Sheet B

This Page Is Retained With Job Book as Permanent Record

Type of Materials	Quantity Required	Estimated Cost	Location Where Materials Are to Be Installed (Walls, Ceiling, etc.)	Installation Figure No.	Special Instructions
			1. Walls - 3½" Cellulose 2. Ceiling - 6" Cellulose		

Total Cost ☐

Pay-off Time

This is the number of seasons for fuel savings to pay off the cost of weatherization.

☐ Total cost (from job sheet above)
1 Fuel factor (Fuel oil = 1, Natural gas = 120, Electricity = 30, Wood = .01)
x ☐ Total heating units saved (from page 10)
x $.63/a. Price of fuel per gal, cu.ft., kWh, cord

= ☐ "Pay-off" time (heating seasons)

HEAT GAIN CALCULATIONS
(for house described in heat-loss problems)

Assuming the following design conditions, determine:

- a) Equivalent Temperature Differentials (E.T.D.'s) for walls, ceilings, and floors (see step 1E of class notes),
- b) Heat Gain through north and west windows (see step 4),
- c) Heat Gain through north and west walls (see step 5),
- d) Heat Gain due to infiltration (see step 6),
- e) Heat Gain through the ceiling (see step 5).

Given:

1) Note description of building at beginning of this section.
2) Note R values developed for heat loss calculations.
3) Design temperatures -
    - a) outdoor dry bulb = 90°F
    - b) indoor dry bulb = 75°F
    - c) outdoor temp. range = moderate
    - d) indoor temp. swing = 3°F

ESTIMATING HOT WATER SYSTEM OUTPUT

Given:

1) 40 gallon gas-fired hot water heater
2) Recovery rate = 40 gal/hour
3) Input = 47,600 btu/hour
4) Hot water demand over two hour period -
    a) 3 loads of wash
    b) 1 load of dishes
    c) 6 gallons for other purposes

Problem:

Determine -

a) Demand in gallons and gallons per hour for two hour period,
b) Hot water system output in gallons and gallons per hour for the two hour period.

WILL THIS SYSTEM MEET THE DEMAND?

ENERGY USE SURVEY: PROCEDURES AND TECHNIQUES

The following are two basic references that are instrumental in developing the Energy Use Survey module objectives in Volume i (p. 65).

Project Retrotech Handbook, Federal Energy Administration, Washington D.C. 20461, and the ASHRAE Handbook of Fundamentals, 1972.***

***Please refer to Volume iii for the Procedural Guidebook detailing the development and execution of the Energy Use Survey.

COMMUNITY EDUCATION

The following materials are used to meet the Community Education module objectives in Volume i (pages 69 and 70).

Objective	Resource
1	Lecture material discussing the need for education of the Community on energy matters.
1	Topic outline on "Community Education"Resource A.
1	Handout on "People Involvement, People Power, and Community Organization", Resource B
2	Student generated material on "Community Education - Workshop Preparation", Resource C
3	Student generated material on "Rationale for Mailing List - Project EFFECT", Resource D, "Mailing List Procedures for Project EFFECT", Resource E, and "Mailing List Profile", Resource F.
3	Handout on "The Press Release" Resource G.
4	Questionnaires used at end of workshops.
5	Practice interview techniques with videotape machine, Assertiveness Training.
Evaluation	Instructor evaluation of student-run workshops.

COMMUNITY EDUCATION - TOPIC OUTLINE

Revised - May 18, 1978

I. COMMUNITY ANALYSIS

General Objective: The student will be able to analyze a community or neighborhood and identify the type of people who live there, the power sources, the main avenues of communication, and important institutions.

A. Who lives in the community?
...Income/professional level
...Education
...Political preference
...Religious affiliation

B. What are the major institutions?
...Schools
...Churches
...Neighborhood Centers
...Business groups
...Clubs

C. What are the major sources of power?
...Congressmen
...Bank officials
...Utility company executives
...Chamber of Commerce

D. What are the lines of communication?
...Newsletters
...Bulletin boards in centers and churches
...Local TV and Radio
...Newspapers

II. IDENTIFYING TARGET GROUPS

General Objective: The student will be able to identify and choose which group(s) she/he should be working with and be able to formulate a rationale for selection.

A. Who are the target groups?
...Church
...Neighborhood center
...Headstart parents
...REAL Services
...Housing Allowance
...Work-related, i.e., group of foremen or fellow workers in a commercial or light industrial setting.

B. Why are they selected?
...need (elderly, poor)
...visibility
...maximum dissemination of information
...work-related, i.e., as part of job situation where this constitutes only part of their responsibility.

RESOURCE A

I. GETTING A CROWD: HOW TO DESIGN A PUBLICITY CAMPAIGN

General Objective: The student will be able to design and carry out a strategy for publicizing various types of community - public education activities.

A. What kind of activity?
...Mass meeting
...Public seminar
...Community workshop

B. What kind of people? How many? What are the steps in the campaign?
...Identify target
...Determine needs, i.e. brochure, flyers, TV appearance, etc.
...Write copy
...Identify printers, paper source, etc.
...Figure costs
...Assemble a mailing and dissemination list including places for posters
...Doing a mailing
...Phone campaigns and follow-up

C. Utilizing the Media
Objective: The student will know the sources of media exposure and will know how to get the desired exposure.

1. What are the media?
...Newspapers
...TV stations
...Radio stations
...private, i.e., clubs - organization newsletters, church bulletins.

2. How are they approached?
...Whom to call (Public Service & Public Affairs Departments)
...When to call (deadlines, etc.)
...Rules of the game (don't play favorites)

D. Writing Public Relations materials
Objective: The student will be familiar with various formats for disseminating materials, will be able to choose the appropriate one for the job, and will be able to carry it out.

1. Who is the audience?
2. What do you want them to know?
3. What are some types of material?
...Brochure
...News release
...Direct mail flyer
4. How do you design and write these different types of material?
...kind of copy
...deadlines
...categorize recipient
...choice of materials (paper, printers, etc.)
...costing it out

IV. PROGRAM PLANNING AND ADMINISTRATION

General Objective: The student will know the logistics of setting up various types of community education activities and will be able to suit the format to the group.

A. Planning the meeting - agendas.
   ...Objectives of the activity
   ...time alloted
   ...division of time

B. Physical arrangements -
   ...size of facility
   ...structuring communication
   ...round table or conventional lecture set-up
   ...refreshments - what and why

C. Support media - audio-visual, hand-outs, etc.

D. Expert speakers

E. Methodology for reaching different groups

General Objective: The student will be able to employ several alternative methods for working with groups and will be able to select the method(s) and topics appropriate for different types of groups and situations.

1. What are some ways of working with groups?
   ...Lecture presentations
   ...Panel seminars
   ...Workshops/"hands-on" experiences
   ...Lecture/discussion

2. What must be considered when choosing a format?
   ...Socio-economic level
   ...Educational level
   ...Size of group
   ...Group orientation, i.e., church, business, service club, school, etc.

3. What must be considered when choosing a topic?
   ...Group needs
   ...Ability to act on what they're learning
   ...Education level
   ...Timeliness

V. FOLLOW-UP

General Objective: The student will be able to evaluate the community education education activity in terms of its objectives

A. What were the objectives of the activity?

B. Did it do what it set out to do?

C. How do we find out?
   ...Questionnaires on the spot
   ...Follow-up phone calls
   ...Follow-up questionnaires
   ...Changes in behavior - how to measure

RESOUCE A

VI. GROUP DYNAMICS - (ongoing - in progress)

General Objectives: The students will learn effective ways of communicating with each other through group and team work activities and will improve communication skills for transfer to job situations

A. Activities completed or in progress
   1. Orientation - group work and team formation
   2. Weekly critique and discussion
   3. Team activities and periodic regrouping
   4. Image feedback - student and staff communication workshop

B. Activities planned
   1. Communication skills workshop
   2. Assertiveness training workshop
   3. Ongoing work in teams with continued changing of team patterns
   4. Job planning

SESSION ON PEOPLE INVOLVEMENT, PEOPLE POWER, AND COMMUNITY ORGANIZATION

1. Why Organize?
2. The people are what is most important
3. The world as it is or the world as it ought to be?
4. Power structures and community analysis: How to get what you want done
5. South Bend and St. Joseph County Indiana
6. Finding and developing leadership
7. Issues
8. Strategy
9. Media and how to best utilize it
10. How to analyze a neighborhood or community

WHY ORGANIZE?

I. To enable human dignity

- A. By allowing those people affected to state their own priorities as opposed to others stating them for them

- B. To enable people to be dependent on themselves
    1. In contrast to Big Brother taking care of you (Facism)
    2. In contrast to the Lady Bountiful mentality (Paternalism)
    3. In contrast to the Welfare Worker (Welfarism)

- C. To enable people to lead and speak for themselves
    1. In contrast to leader living outside community (Colonialism)
    2. In contrast to the outside establishment picking local people to lead for them (Neo-Colonialism)

II. To enable democracy to really work--to put meaning and reality into the phrase "by the people."

III. To enable many people to grow more--the individual growth that occurs when as part of a delegation of 50 people you win something that you never thought you could and you know you won it because you were present.

IV. To enable a constituency (block, neighborhood, community, city, county, state) to determine and bring into being its own destiny.

V. To enable existing conflicts to come to the surface to be dealt with--to avoid these conflicts is to allow them to fester and grow and erupt later in dangerous explosions.

VI. To continually shift the relationship between the "haves" and the "have-nots".

VII. Organizations, not individuals, bring about social change.

COMMUNITY EDUCATION - WORKSHOP PREPARATION

PEER PRACTICE

1) In teams, write objectives, identify target audience

2) Write publicity - samples of news release, flyer, etc. - with objectives and target audience in mind

3) Teams make timeline and assign responsibilities for each aspect of the workshop

4) Present "Workshop Package" to peers including:

   Target Audience
   Logistics
   Publicity Materials
   Handouts
   Visuals
   Evaluation Plan

5) Present 15 minute mini-workshop to peers including explanation of objectives, audience, rationale and materials.

RESOURCE C

Major Workshops Presented by EFFECT Trainees

1) Project RENEW, Inc. - funded by Catholic Charities and Federal money

RENEW acquires houses and sells on land contract to people eligible by virtue of financial status. Some rehabilitation money is also provided.

Prospective home-owners are required to attend a series of workshops on home maintenance, of which this is one.

Audience: 20-25 prospective home owners in their 20's or 30's

Objectives: Emphasis on what to look for when house hunting; no cost and low cost conservation tips; priorities for weatherization.

2) H.O.M.E. - Elkhart, Indiana - Branch of ACTION, Inc.

Audience: 10-15 HOME personnel

Objectives: Workshop for caseworkers and other personnel - Energy tips and weatherization priorities were emphasized.

3) ACTION, Inc. - South Bend, Indiana

Audience: 20-30 personnel - caseworkers, weatherization workers, board members from neighborhood ACTION Centers.

Objectives: Demonstration of various types of weatherization materials; weatherization priorities; no cost and low cost energy conservation tips.

RESOURCE C

RATIONALE FOR MAILING LIST - PROJECT EFFECT

I. Project EFFECT

1. Information for the public on what project EFFECT is all about.
2. Contacts for job placement.
3. Explaining an Energy Extension Agent.
4. Keeping in the public eye.
5. Establish some level of credibility.
6. Practice for future jobs.

II. General Energy

1. Establish interest in Energy and Conservation as a whole.
2. Possible information for concerns that don't have an immediate need for Project EFFECT services.
3. Demonstrating that there is something organized and actually occuring, addressing the energy problem.

III. Project EFFECT Participants:

. . . . . affirm that Project EFFECT does have a direction and is going places.

. . . . . establish pattern or technique of dealing with people and generating.

RESOURCE D

MAILING LIST PROCEDURES FOR PROJECT EFFECT

Index: General Format: Type of Mailing and to whom

1) Content (C)
2) Evaluation (E)
3) Follow-up (FU)

A. Introductory Mailing (the general whole) to all possible parties

   1) Introduce Project EFFECT (PE) in a simple, yet effective, form, laying out categories (specifics) that make up the program.

   2) E = by phone, using questionnaire (may have to call everyone) or use return mail questionnaires and random calling: interested? further mailings: specific or whole? wait? cancel?

   3) FU = dictated by questionnaire returns.

B. Specific Mailing to Interested Parties

   1) C = different categories of program: Conservation; Training; Project activities; etc.

   2) E = questionnaire to be mailed back to Project EFFECT.

   3) FU = a. Wait for returns

      b. random calls

      c. separate packets made up for different categories (References, Resources, etc.)

Interim mailing as new information develops, would go to appropriate mailing class.

C. Holistic Mailing (Specifics of the General Whole) to interested parties.

   1) Specifics on each category
   2) E = feedback from mailee (group contacted)
   3) FU = dictated by feedback

D. Energy Information Resource Mailing (possible future scope) to interested parties.

   1) Send out feeler, listing services (perhaps just serve local area). (C)
   2) Wait for feedback or randomly sample (E)
   3) FU dictated by feedback, plus follow-up on what inquiries are actually doing (projects, services, etc.)

MAILING LIST PROFILE

B - Social Welfare
B Urban League - St. Joseph County (179)
D United Way Board - St. Joseph County (33)
M Community Organization Directors (42)

C General Social Service - Women
N YWCA Board (27)

D General Service Organizations - Men
A Lions - South Bend (84)

E General Service Organizations
E Community Clubs - President/Director (68)

F Business
A Roseland Businessmen 1/75 (33)
C Realtors Areas Outside St. Joe County (139)
D Realtors in St. Joe County 1/76 (410)
S Transportation Companies, So. Bend - Elkhart

G Business
C Small Business series - spring 1974 & fall 1975 (97)
V Elkhart (members 1977 construction) (ord. by pos.) (40) President
W St. Joseph County Industry size -01 to 300 (ord. by pos.) 54 President
7 Realtors for S.W. Michigan w/names 7/77 (425)
(Berrien & part of Van Buren and Cass)
8 South Bend transportation Club (7/77) (128)
9 Northern Indiana transportation Club (51)
(7/77) Motors Carrier Associated)

H Business
B Names & addresses of main banks in S.B./Elkhart County 12/76 (11)

L Religious groups
A United Religious Community of St. Joe County 1975 (27)
H United Religious Community of Elkhart County 1975 (15)

M Engineers
B Engineers - Indiana Society of Professional(158
Engineers of St. Joseph Valley S.B./M. 76/77
C Engineers - American Society of Civil Engineers 1/77 (79)
D Engineers - Indiana Society of Professional Engineers of Ellakono
Chapter (Elkhart, Goshen) 76/77 (88)

N Government
E Indiana legislators - St. Joseph County 1/77 (8)
F Government officials - City and five Indiana Counties by
positions 1976 (230)

P Educators
N I.U.S.B. Board of Advisors (11)
V I.U. Regional campuses (21)
W I.C.C.E. (12)

Q Miscellaneous
B Area Libraries 1/75 (23)
N Area News Media (76)
C Miles "Thought Leaders" 1/75 (92)
F Environmental Michiana Watershed (68)

S **Health**

A Hospitals in northern Indiana selected general (ord. by Pos.) (24) (Director)
B Nursing Home in northern Indiana selected (ord. by pos.) 48 (Director)
E I.S.P.C.E.M. Region II 3/77 (23)

PLUS

All presidents of Chambers of Commerce in four county area - 29

All presidents or Dept. Chairmen of Colleges and Universities in four county area.- 10

All local contractors and architects.- 27

NATIONAL

All members of Congress (539)

All Embassies (124)

Chairmen of the Board - 25 major national utility companies

Governor's of 50 states

HUD Regional Directors - nationwide - 54

Executives Major Oil Companies - 15

Presidents or Dept. Chairmen of Colleges & Universities - nationwide - 72

Special letter - nationwide - Educators in Energy Conservation - 80

Various Energy Related companies and Publishers of Energy materials - 35

RESOURCE F

THE PRESS RELEASE

Follow these simple rules in putting together your press release.

1. Use white 8 1/2 x 11" paper. Type on one side of each sheet and make carbons or photocopies. Keep the original for yourself and turn in two copies to the Editor.
2. Double space. Leave an inch and a half margin on either side, top, and bottom of copy, but don't end a page in the middle of a paragraph.
3. Identify yourself and your story on page one, drop down about 3 inches and identify the story in five words or less on the left side of the page. Drop down a few lines and put your name, address, and phone number. Include the release date (the day on which you want the story to be run). On succeeding pages use a two or three word story identification in the top left corner. Under it put "add 1" on second page, "add 2" on third page, etc.
4. Put "more" at the bottom of each page if more than one page. Put"###" at the bottom of the last page.
5. Indent all paragraphs five spaces.
6. Begin the story about half way down the first page and five or six lines down on each succeeding page.

Along with the typed release, include a fact sheet that simply outlines the who's, what's when's, and where's.

Also send a covering letter that briefly introduces you. . . . .

. . . . . Offer to schedule interviews.

RESOURCE G

SAMPLE

12111 Wallace Street
Crown Point, IN 46307
September 4, 1975

The Honorable Birch Bayh
United States Senate
Washington, D.C. 20510

Dear Senator Bayh:

Since it is one of your duties from time to time to consider funds for the National Endowment for the Humanities, I thought you would be happy to learn that there will be a project in your district this fall.

The Lake County Public Library, the Crown Point-Center Public Library and the Leaque of Women Voters of Crown Point feel fortunate to have received matching funds from the Indiana Committee for the Humanities in cooperation with the National Endowment for the Humanities which will allow us to offer four evenings of dialogue on intellectual freedom to the public without cost.

Outstanding speakers have been secured for these Freedom Forums and we are anticipating stimulating evenings of exchange with local facilitators encouraging the public to participate; we are hopeful a cross section of our population will attend and benefit from the experience.

The attached flyer gives you details; if you wish further information please call me at 219-663-5038 or Jackie Headly, project director, at 219-663-8350. If it is possible for you to be in your home district on any of these dates we would like for you to consider this a personal invitation to attend.

Sincerely yours,

Jerry S. Hatcher
Publicity Chairman

Enc.

RESOURCE G

STATE AND LOCAL GOVERNMENT

The following materials are used to meet the State and Local Government module objectives in Volume i (p. 77).

Objective	Resource
1	Detailed publication on organization of city government, Civic Cinema, South Bend Civic Planning Association, 29th Edition, 1977.
2	Lectures by instructor
3	Attend City Council and Board of Public Works meetings.
3	Publication, Here Is Your Indiana Government, Indiana State Chamber of Commerce, 18th edition, 1977.
4	Presentation by Indiana State Senator
Evaluation	Exam Resource A

Project EFFECT

State and Local Government Module

Final Exam

1. Why is it difficult for state government, (the executive and legislative) to act on important policy matters like energy?
2. What is the responsibility of the Public Service Commission in state energy matters?
3. What is the job of "public counselor" on the state level?
4. Why does the state make it difficult for cities to undertake new programs?
5. What are the duties of the City Council and the Board of Public Works?
6. What is meant by the term "police powers"?
7. How does the Constitution guarantee individual rights?
8. What are the major "energy issues" facing government today? (Federal, State and local)
9. What can state government do to help solve the energy crisis?
10. What can cities do to help solve the energy crisis?

REGIONAL DEMOGRAPHY

The following materials are used to meet the Regional Demography module objectives in Volume i (page 80).

Objective	Resource
1	The 1970 Census and You, U.S. Department of Commerce, Bureau of the Census.
1	"Factfinder for the Nation" on: "Housing Statistics", "Minority Statistics", "Construction Statistics", "Georgraphic Tools", and "Population Statistics", U.S. Department of Commerce Bureau of the Census.
1	Maps of existing land use for Community Development Program in South Bend, Indiana.
1	Maps of Census Tracts for South Bend, Indiana.
Evaluation	Quizzes Resources A-C.

QUIZ #1

1. A city of at least 50,000 plus counties that are socially and economically related to that city is called a:

   1. Urbanized area
   2. Census tract
   3. Standard metropolitan statistical area
   4. Unincorporated place

2. The smallest geographical unit for which one can obtain income data is

   1. Blocks
   2. Census tracts
   3. Cities
   4. Counties

3. Information on the average amount of rent that people in some geographical areas pay can be found in

   1. The Census of Business
   2. The Census of Population
   3. The Census of Housing
   4. The Census of Government

4. If you are interested in finding out information about neighborhood housing characteristics, the best source of information is likely to be

   1. Block statistics
   2. Tract statistics
   3. Data for unincorporated places of 1000 or more
   4. Population summary for United States

5. Census volumes designated PHC will have information on

   1. Population characteristics only
   2. Housing
   3. Special subjects
   4. Both housing and population characteristics

RESOURCE A

QUIZ #2

1. In most cities, the oldest housing is likely to be found

    1. In the suburbs on the outer edge of the city
    2. Scattered throughout the city
    3. Close to the center of the city

2. A housing unit refers to

    1. Any building in which people live
    2. Any room with at least one person in it
    3. Only apartments
    4. A group of rooms or single room occupied by or intended for occupancy as separate living quarters

3. Housing information for neighborhoods can be found in

    1. Only in the block statistics for urbanized areas
    2. In both the census tract for SMSA's and in the block statistics for UA's
    3. In the population census by state
    4. In special topic volumes

4. The term housing tenure refers to

    1. The age of the housing unit
    2. How many rooms the unit has
    3. What kind of heating the unit has
    4. Whether the unit is owner occupied, renter occupied or vacant

5. Gross Rent is

    1. The amount a household pays to the landlord for rent plus all other parts of housing like utilities, and heat costs per month
    2. Only the amount paid to the landlord whatever that may be
    3. The amount paid for the whole year as opposed to the amount paid per month
    4. Rent paid for furnished apartments instead of unfurnished

QUIZ #3

1. Most of the ethnic households in South Bend live in

   1. The south side
   2. The west side
   3. The north side
   4. The east side

2. Which of the following will probably detract from the value of a house?

   1. Being brick instead of wood frame
   2. Being close to a slum neighborhood
   3. Being more than a block from a shopping center
   4. Being located on a quiet street

3. Absentee landlords are less likely to repair housing in a deteriorating neighborhood because of

   1. Positive external effects and negative external effects
   2. Inability to get money for rehabilitation
   3. The sense that the neighborhood is deteriorating and thus it will be lost
   4. All of the above
   5. None of the above

4. The county area outside the city is likely to be socially, ethnically, and economically

   1. Less varied than the city
   2. More varied than the city
   3, About the same
   4. Better than the city

5. Probably the most expensive housing in the South Bend Metropolitan area is found in

   1. The west side
   2. Clay township
   3. The rural county areas
   4. Mishawaka

RESOURCE C

NEIGHBORHOOD AND COMMUNITY ORGANIZATION

The following materials are used to meet the Neighborhood and Community Organization module objectives in Volume i (p. 74).

Objective	Resource
1	Handout on, Southeast Neighborhood Target Area Resources A-E.
2	Handout on, What to Look for in Groups Resource F.
3	Discuss handout Proposed Developments for Target Area Resource G.
4	Lecture material
Evaluation	Exam Resource H

PROJECT EFFECT
IUSB

Southeast Neighborhood Target Area
Census Tracts 17, 29, and 30

EXISTING LAND USE

The Southeast Neighborhood Area is predominantly residential (single family) in character. Most of the structures are large two- and three-story frame houses built prior to 1940. A good portion of the 59 two-and multi-family structures are merely conversions of single family houses.

Commerical land uses are generally found along the east and west boundaries of the Southeast Neighborhood target area. The 166 commercial structures along these streets are farily well mixed between retail and service businesses. Industrial uses are found only in the upper two-thirds of the Southeast, census tracts 17 and 29. All seven (7) industrially-used structures are in very close proximity to the Grand Trunk Western/New York Central Railroad tracks which are elevated throughout the upper one-half of the neighborhood. Segments of existing industrial zones in the Southeast are adjacent to residential zones and by being so represent environmental as well as aesthetic problems for residents.

Existing land uses and projected zoning are not entirely consistent with one another; this is especially true in census tract 17 where general commercial, high-density residential/office, and light/heavy industrial comprise the only projected land uses to the year 1990.

Vacant properties are perhaps the most significant land "uses" in the entire neighborhood. The reason being that there exist approximately 344 vacant land parcels - ranging from one-tenth of an acre to two-and one-half acres - and 152 vacant structures. A key factor regarding the vacant structures is that 113 of these are owned by individuals who live outside of the Southeast Neighborhood Area.

Municipal Services

- Vacant properties (land and buildings) are for the most part unkept and littered; weeds are allowed to grow unabated and maintenance is irregular if at all.
- Bus service to and throughout the southeast neighborhood appears to be adequate.
- Significant number of public complaints regarding garbage (117) and trash (146) violations were received by the environmental control office during the 1976 calendar year.

Population

According to the 1960 and 1970 Census and 1975-76 Polk data the Southeast Neighborhood Target Area has been losing an average of 390 persons per year since 1960. The total decline of 6,250 persons represents a 54.8 percent drop over a sixteen-year period. This percentage drop is nearly four and one-half times the citywide figure for the same period of time.

The Southeast Neighborhood's population decline results in a current 1976 population estimate of 5,322 persons. Cencus tract 30 claims about one-half of the area's population (2591 persons), tract 29 comprises 37.0 percent (1972 persons) and tract 17 makes up the remaining 13.0 percnet (758 persons).

The lack of population stability in the Southeast Neighborhood area is evident and is a major problem. Whether it is a cause or an effect of neighborhood problems depends on one's point of view. It

Southeast Neighborhood Target Area (Cont'd)

appears however that population decline is strongly connected to social/physical changes particularly in the upper two-thirds to this neighborhood.

According to the 1970 census, 36% of the population of the Southeast Neighborhood Area were Black. This percentage is presumed to have increased substantially (particularly in census tracts 17 and 29).

The small (3%) Spanish-Speaking population in 1970 is presumed to have relocated to the Southwest Neighborhood area.

Housing

Over the 16-year period beginning in 1960 the Southeast has lost 39% of its total housing stock. High rates of residential demolitions have characterized the Southeast neighborhood between 1970 and 1976; an average of 68 dwelling units have been demolished per year since 1970. The Southeast has the highest vacancy rate (17.7%) and highest abandonment rate (11.1%) of all neighborhood target areas. Substandard housing structures (481) represent approximately 32% of all residential structures in the Southeast neighborhood; 455 structures are deteriorating and 26 are dilapidated. Of the 455 deteriorating structures, 120 are vacant. Of the 26 dilapidated structures (which represent those requiring demolition), 10 are occupied.

Lower-Income Households

Lower-income households in the Southeast Neighborhood Target Area (1,113) represent approximately 60.0 percent of its total number of households in 1976. The vast majority of lower-income households in this area are retired heads of household (600) and live on "fixed" income. Jobless heads of households number 308 while unskilled and service workers total 120 and 85, respectively. These figures have not changed appreciably from a year ago.

CENSUS TRACT 17 - #1

portion bordered by MONROE Street on the north, SAMPLE Street on the south, LINCOLN WAY EAST on the east and MICHIGAN AVENUE on the west.

Given the major factors listed below and their interrelationships this section of Census Tract 17 is classified as BLIGHTED. These factors are:

- 72.0 percent population decline betwen 1960 and 1976,
- 154 housing units were demolished between 1970 and 1976,
- 81 substandard housing structures currently exist; 79 are deteriorating and 2 are dilapidated,
- 120 vacant land parcels and 42 vacant structures currently exist, and
- disregarding vacant properties, the predominant land use i represented by commercial and industrial establishments

NOTE: Though this segment of tract 17 is classified as blighted there are several blocks which are in reasonably good condition and require special attention in terms of implementing rehabilitation and preservation strategies. There are also several blocks which are heavily vacant (e.g. vacant lots/ vacant structures) which need to be used in such a way to support rehabilitation preservation efforts throughout the remaining blocks.

PROJECT EFFECT
IUSB

CENSUS TRACT 17 - #2

portion bordered by MONROE Street on the north, BRONSON Court on the south, EDGEWATER Street on the east and LINCOLN WAY EAST on the west.

Given the major factors listed below and their interrelationships this section of census tract 17 is classified as STABLE. These factors are:

- a fairly constant population level since 1960,
- no housing units were demolished between 1970 and 1976,
- 9 substandard housing structures currently exist, none of which are dilapidated,
- 2 vacant land parcels and 1 vacant structure currently exists, and
- the predominant land use is single-family residential with commercial establishments confined to frontage property along Lincoln Way East.

NOTE: Though this segment of tract 17 is stable there exists a potential problem where commercial, single-and multi-family uses front Lincoln Way East. There are four deteriorating structures, all residential, which should be monitored for changes in condition.

PROJECT EFFECT
IUSB

CENSUS TRACT 29 - #1

portion bordered by SAMPLE Street on the north, THE ALLEY BETWEEN PENNSYLVANIA AND BROADWAY Streets on the south, LINCOLN WAY EAST/MIAMI Street on the east and MICHIGAN AVENUE on the West.

Given the major factors listed below and their interrelationships this section of census tract 29 is classified as BLIGHTED. These factors are:

. an estimated 60.0 percent population decline between 1960 and 1976,

. 177 housing units were demolished between 1970 and 1976,

. 118 substandard housing structures currently exist; 109 are deteriorating and 9 are considered dilapidated,

. 115 vacant land parcels and 35 vacant structures currently exist, and

. land here is distributed evenly among industrial, commercial and park/open space, and single family residential uses.

NOTE: Though this segment of census tract 29 is classified as blighted there are a few blocks which have housing that is deteriorating but requires minor repairs as opposed to major repairs. The heavy concentration of vacant properties compounds the physical and environmental problems evident throughout this portion of tract 29.

PROJECT EFFECT
IUSB

CENSUS TRACT 29 - #2

portion bordered by THE ALLEY BETWEEN PENNSYLVANIA AND BROADWAY Streets on the north, INDIANA Avenue on the South, MIAMI Street on the east and MICHIGAN Avenue on the west.

Given the major factors listed below and their interrelationships this section of census tract 29 is classified as DOWNWARD TRANSITIONAL. These factors are:

. an estimated 40 percent population decline between 1960 and 1976,

. 35 housing units were demolished between 1970 and 1976,

. 98 substandard housing structures currently exist; 90 are deteriorating and 8 are dilapidated,

. 34 vacant land parcels and 30 vacant structures currently exit, and

. land use is predominantly single-and two-family residential

NOTE: Though this segment of tract 29 is considered downward transitional several blocks are in fair to good condition. Similar to tract 17, the use to which vacant properties will be put must be coordinated with overall rehabilitation/preservation efforts.

This information is from the Southeast Neighborhood Planning Profile prepared by the South Bend Bureau of Planning -- January, 1978.

WHAT TO LOOK FOR IN GROUPS

In all human interactions there are two major ingredients — content and process. The first deals with the subject matter or the task upon which the group is working. In most interactions, the focus of attention of all persons is on the content. The second ingredient, process, is concerned with what is happening between and to group members while the group is working. Group process, or dynamics, deals with such items as morale, feeling tone, atmosphere, influence, participation, styles of influence, leadership struggles, conflict, competition, cooperation, etc. In most interactions, very little attention is paid to process, even when it is the major cause of ineffective group action. Sensitivity to group process will better enable one to diagnose group problems early and deal with them more effectively. Since these processes are present in all groups, awareness of them will enhance a person's worth to a group and enable him to be a more effective group participant.

Below are some observation guidelines to help one process analyze group behavior.

Participation

One indication of involvement is verbal participation. Look for differences in the amount of participation among members.

1. Who are the high participators?
2. Who are the low participators?
3. Do you see any shift in participation, *e.g.*, highs become quiet; lows suddenly become talkative. Do you see any possible reason for this in the group's interaction?
4. How are the silent people treated? How is their silence interpreted? Consent? Disagreement? Disinterest? Fear? etc.
5. Who talks to whom? Do you see any reason for this in the group's interactions?
6. Who keeps the ball rolling? Why? Do you see any reason for this in the group's interactions?

Influence

Influence and participation are not the same. Some people may speak very little, yet they capture the attention of the whole group. Others may talk a lot but are generally not listened to by other members.

7. Which members are high in influence? That is, when they talk others seem to listen.
8. Which members are low in influence? Others do not listen to or follow them. Is there any shifting in influence? Who shifts?
9. Do you see any rivalry in the group? Is there a struggle for leadership? What effect does it have on other group members?

Styles of Influence

Influence can take many forms. It can be positive or negative; it can enlist the support or cooperation of others or alienate them. *How* a person attempts to influence another may be the crucial factor in determining how open or closed the other will be toward being influenced. Items 10 through 13 are suggestive of four styles that frequently emerge in groups.

10. Autocratic: Does anyone attempt to impose his will or values on other group members or try to push them to support his decisions? Who evaluates or passes judgment on

other group members? Do any members block action when it is not moving the direction they desire? Who pushes to "get the group organized"?

11. Peacemaker: Who eagerly supports other group members' decisions? Does anyone consistently try to avoid conflict or unpleasant feelings from being expressed by pouring oil on the troubled waters? Is any member typically deferential toward other group members — gives them power? Do any members appear to avoid giving negative feedback, *i.e.*, who will level only when they have positive feedback to give?

12. Laissez faire: Are any group members getting attention by their apparent lack of involvement in the group? Does any group member go along with group decisions without seeming to commit himself one way or the other? Who seems to be withdrawn and uninvolved; who does not initiate activity, participates mechanically and only in response to another member's question?

13. Democratic: Does anyone try to include everyone in a group decision or discussion? Who expresses his feelings and opinions openly and directly without evaluating or judging others? Who appears to be open to feedback and criticisms from others? When feelings run high and tension mounts, which members attempt to deal with the conflict in a problem-solving way?

Decision-Making Procedures

Many kinds of decisions are made in groups without considering the effects of these decisions on other members. Some people try to impose their own decisions on the group, while others want all members to participate or share in the decisions that are made.

14. Does anyone make a decision and carry it out without checking with other group members? (Self-authorized) For example, he decides on the topic to be discussed and immediately begins to talk about it. What effect does this have on other group members?

15. Does the group drift from topic to topic? Who topic-jumps? Do you see any reason for this in the group's interactions?

16. Who supports other members' suggestions or decisions? Does this support result in the two members deciding the topic or activity for the group (handclasp)? How does this effect other group members?

17. Is there any evidence of a majority pushing a decision through over other members objections? Do they call for a vote (majority support)?

18. Is there any attempt to get all members participating in a decision (consensus)? What effect does this seem to have on the group?

19. Does anyone make any contributions which do not receive any kind of response or recognition (plop)? What effect does this have on the member?

Task Functions

These functions illustrate behaviors that are concerned with getting the job done, or accomplishing the task that the group has before them.

20. Does anyone ask for or make suggestions as to the best way to proceed or to tackle a problem?

21. Does anyone attempt to summarize what has been covered or what has been going on in the group?

22. Is there any giving or asking for facts, ideas, opinions, feelings, feedback, or searching for alternatives?

23. Who keeps the group on target? Who prevents topic-jumping or going off on tangents?

Maintenance Functions

These functions are important to the morale of the group. They maintain good and harmonious working relationships among the members and create a group atmosphere which enables each member to contribute maximally. They insure smooth and effective teamwork within the group.

24. Who helps others get into the discussion (gate openers)?

25. Who cuts off others or interrupts them (gate closers)?

26. How well are members getting their ideas across? Are some members preoccupied and not listening? Are there any attempts by group members to help others clarify their ideas?

27. How are ideas rejected? How do members react when their ideas are not accepted? Do members attempt to support others when they reject their ideas?

Group Atmosphere

Something about the way a group works creates an atmosphere which in turn is revealed in a general impression. In addition, people may differ in the kind of atmosphere they like in a group. Insight can be gained into the atmosphere characteristic of a group by finding words which describe the general impressions held by group members.

28. Who seems to prefer a friendly congenial atmosphere? Is there any attempt to suppress conflict or unpleasant feelings?

29. Who seems to prefer an atmosphere of conflict and disagreement? Do any members provoke or annoy others?

30. Do people seem involved and interested? Is the atmosphere one of work, play satisfaction, taking flight, sluggishness, etc.?

Membership

A major concern for group members is the degree of acceptance or inclusion in the group. Different patterns of interaction may develop in the group which give clues to the degree and kind of membership.

31. Is there any sub-grouping? Some times two or three members may consistently agree and support each other or consistently disagree and oppose one another.

32. Do some people seem to be "outside" the group? Do some members seem to be "in"? How are those "outside" treated?

33. Do some members move in and out of the group, *e.g.*, lean forward or backward in their chairs or move their chairs in and out? Under what conditions do they come in or move out?

Feelings

During any group discussion, feelings are frequently generated by the interactions between members. These feelings, however, are seldom talked about. Observers may have to make guesses based on tone of voice, facial expressions, gestures, and many other forms of nonverbal cues.

34. What signs of feelings do you observe in group members: anger, irritation, frustration, warmth, affection, excitement, boredom, defensiveness, competitiveness, etc.?
35. Do you see any attempts by group members to block the expression of feelings, particularly negative feelings? How is this done? Does anyone do this consistently?

Norms

Standards or ground rules may develop in a group that control the behavior of its members. Norms usually express the beliefs or desires of the majority of the group members as to what behaviors *should* or *should not* take place in the group. These norms may be clear to all members (explicit), known or sensed by only a few (implicit), or operating completely below the level of awareness of any group members. Some norms facilitate group progress and some hinder it.

36. Are certain areas avoided in the group (*e.g.*, sex, religion, talk about present feelings in group, discussing the leader's behavior, etc.)? Who seems to reinforce this avoidance? How do they do it?
37. Are group members overly nice or polite to each other? Are only positive feelings expressed? Do members agree with each other too readily? What happens when members disagree?
38. Do you see norms operating about participation or the kinds of questions that are allowed (*e.g.*, "If I talk, you must talk"; "If I tell my problems you have to tell your problems")? Do members feel free to probe each other about their feelings? Do questions tend to be restricted to intellectual topics or events outside of the group?

PROPOSED DEVELOPMENTS FOR TARGET AREA

1. Simplicity Pattern, a light industrial firm, has expressed a desire to locate in South Bend. They have specifically expressed interest in locating in Census Tract 17 near the downtown area. Relocating in this area is contingent on the City Administration accepting a 2 million dollar Urban Development Action Grant (UDAG) from the Federal Department of Housing and Urban Development (HUD) which would finance the purchase of property and construction of a parking facility for Simplicity. HUD has indicated they would fund the project and make the UDAG grant available to the City.

2. In order to finalize plans for the proposed Downtown Century Mall, it has become imperative that the present City bus terminal location at the corner of Jefferson and Main be relocated. The most viable site for relocating the terminal is in Census Tract 17 in the downtown area. The Urban Mass Transportation Administration has agreed to this particular location and is willing to support relocation and construction of a new facility by providing the City a $4,500,000 grant to finance the move. Plans prepared by the Public Transportation Corporation indicate that the Census Tract 17 area provides the most ideal location.

3. A local developer desires to construct 200 units of subsidized housing for the elderly and low income in Census Tract 17. There will be one high rise building and several clusters of small detached houses. City Housing Plans indicate that the Central Business District, and in particular Census Tract 17, offers a good location for the project. The Department of HUD has approved the project and agreed to provide funds for the rental assistance. The developer requires that the project be located in Census Tract 17 because of proximity to Central Business District and another elderly housing complex being developed close by.

4. The Department of Public Welfare has just received word from the Economic Development Administration and Health, Education and Welfare that 8 million dollars in grant monies are available for the construction of a new office building to house the DPW. Federal requirements state the funds can be made available only if new construction occurs in an area defined as blighted, located near the downtown area, and conforms to an overall development plan for the Central Business District Area. Census Tract 17 offers an ideal location for such a project and satifies all federal requirements. The DPW has voiced its support in the project, except City Administration endorsement has not yet been received, which is required.

5. Fun City Amusement Park, a national chain of high quality, high noise, summer fun palaces wishes to locate on the vacant land in the target area. Before building their ferris wheels, parashoot jumps, etc., they need zoning board approval.

6. A wealthy conglomerate is willing to finance the construction of Chic Mall in Census Tract 17. This is an enclosed shopping center of exclusive, snooty and high priced stores, lots of tea shops, exotic plants, Renaissance art and the like. The Mall hopes to draw from the Convention trade at Century Center, and to anchor the revitalized center city. It requires zoning approval, however.

7. About 300 jobs are promised local residents if Famous Foundry, a heavy, dirty, noisy industry locates in South Bend. They will locate here if they receive a federal subsidy, which is only available if they locate in Census Tract 17. They need the approval of the City administration for this subsidy.

Class Discussion: Discuss possible effects (positive and negative) of the preceding seven plans on Census Tract 17.

FIELD OBSERVATIONS - PRACTICUM

The following materials are used to meet the Field Observations module objectives in Volume i (p. 84).

Objective	Resource
1	List of objectives Resource A.
2	Trainee discussion and observations of field experiences.
3	Field representative for Citizens Action Coalition, a local citizen's group involved with utility rates.
Evaluation	Trainee discussion and participation Daily log and evaluation by trainee Resource B Staff evaluation of trainee, Resource C Host evaluation of trainee, Resource D.

Project EFFECT

PRACTICUM: FIELD OBSERVATION

During the first three weeks of June, 1978, the E.E.A.* trainees will be formally introduced to some of the more common job fields that utilize individual components of the Project EFFECT Training Curriculum. The on-site field observation will set the tone of a true job situation with the trainee-observer signing in and out at prescribed times with the worker-host, and logging the daily routine of activities that constitute each unique observation.

Specific objectives to the field observation portion of the practicum are as follows:

As a result of the observations, the E.E.A. trainees will be able to - -

1. gain the practical experience of meeting the public on a very personal basis;
2. become familiar with specific energy consumption and distribution systems;
3. document how various professionals in energy technology perform their individual tasks; and
4. objectively assess their interest in a particular job field.

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* Energy Extension Agent

PROJECT EFFECT

PRACTICUM - OBSERVATION
DAILY LOG AND EVALUATION

NAME OF TRAINEE: ____________________ DATE ____________

OBSERVATION SITE: (include name (company or person), address, and name of host	TIME IN	TIME OUT	SIGNATURE OF HOST

TRAINEE: (list of individual observations, experiences and sites visited)	Time elapsed IN	 OUT	TRAINEE COMMENTS: (a brief statement of what occured, action taken, follow-up planned) use additional paper if necessary
(1) 7			
(2)			
(3)			
(4)			

5) Please use the back for this question: How did these observations relate to your classroom training?

PRACTICUM - OBSERVATION

STAFF EVALUATION SHEET

NAME OF TRAINEE DATE TIME OBSERVATION SITE

Rate the trainee on a scale of 0-5: 0 meaning not observed, 5 indicating outstanding performance

	0	1	2	3	4	5
The trainee asked questions...showed interest in what was happening						
Could explain what he/she was seeing						
Could communicate with the host and the public						
Was appropriately dressed						
Could relate observation to the rest of the training						

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COMMENTS:

RESOURCE C

SIGNATURE OF SUPERVISOR:

HOS[redacted]: [redacted]ease [redacted]te the[redacted]raine[redacted] on [redacted] fo[redacted]ing [redacted]int[redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]RAI[redacted] NA[redacted] [redacted] [redacted] [redacted]

DATE: ____________________

	OUTSTANDING	SATISFACTORY	NEEDS IMPROVEMENT	NOT OBSERVED	COMMENTS:
The trainee was on time					
The trainee asked questions that showed adequate background					
The trainee was interested in what was happening and participated actively, where appropriate					
The trainee was able to communicate adequately with you and the public					
Overall rating:					

HOST SIGNATURE: ________________________________

ENERGY USE SURVEYS - PRACTICUM

The following materials are used to meet the Energy Use Surveys module objectives in Volume i (p. 90).

Objective	Resource
1	Statement of purpose Resource A.
1, 2, 3	Project Retrotech Handbook, FEA, Washington DC 20461. ASHRAE Handbook of Fundamentals, 1972***
Evaluation	Critique of audit components.
Evaluation	Staff evaluation of individuals as to their ability to conduct energy use surveys independently.

***Please refer to Volume iii for the Procedural Guidebook detailing the development and execution of the Energy Use Survey.

PRACTICUM: AUDITS

Throughout the first six weeks of the practicum phase, the E.E.A.* trainees will perform a series of energy use audits on individual residences under progressively decreased supervision. The audits will be specific to the structures visited and will be comprehensive surveys of the existing household energy efficiency.

The ultimate objective will be to develop in each individual trainee the ability to engage in independent onsite inventorying, offsite evaluation of data collected and subsequent onsite advisement of personnel for any given residential or small commercial structure. Practice audits will be documented and filed in the specific trainee's portfolio after being critiqued by Project supervisor(s). These audits will serve as a means of evaluating the capability of each trainee as well as preparing them for career placement. Secondary objectives of the process will be development of a well refined and practical audit procedure verified by comparison with actual energy consumption patterns encountered in the field, and identification of possible revisions of the E.E.A. training curriculum.

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*Energy Extension Agent

NEIGHBORHOOD WORKSHOPS - PRACTICUM

The following materials are used to meet the Neighborhood Workshops module objectives in Volume i (p. 87).

Objective	Resource
1	Weatherization Director, ACTION, Inc. and Resource A.
2	Instructor from Community Education module.
2	Student generated materials Resources B and C.
Evaluation	Student evaluations of each other's presentations.
Evaluation	Staff evaluation of effectiveness of workshop presentation.

PROJECT EFFECT

PRACTICUM: NEIGHBORHOOD WORKSHOPS

Critical to the ultimate effectiveness of this community adult education project is a facet focusing on and utilizing the dynamic factors that tie community groups together.

This facet of the practicum experience will strive to prepare the energy extension agents to interact with and through effective neighborhood agents; reacting to their needs and concerns, and assisting them in energy related problems and analyses. These agents (depending on the neighborhood) might be churches, community groups, and/or social service agencies. Neighborhood workshops will be jointly developed dealing with specific problems and educational objectives (e.g., how to efficiently and effectively insulate a water-heater). The focus as well as the specific needs addressed in the workshops will be determined by the neighborhood groups themselves, working with and assisted by the Energy Extension Agent (EEA). The ultimate goal is to activate neighborhood awareness and mutual concern, culminating in energy reduction, conservation, and savings at the local neighborhood level.

THINGS TO LOOK FOR WHEN BUYING A HOUSE

Inside:

1. Cracks and caulking around windows.
2. Cracks in ceiling and walls.
3. Is there insulation in the attic?
    a) How much?
    b) What kind?
4. Weatherstripping around the doors?
5. Is there a crawl space?

Outside:

1. Storm Doors
2. Storm windows and screens
3. Peeling paint on window sills and siding
4. Foundation cracks
5. Awnings
6. Ventilation in attic

Questions to be asked:

1. Ask about fuel consumption - ask to see records of past utility bills - if these are unavailable, the utilities will provide the homeowner with records of fuel consumption and will help you figure out how much it cost.

2. What type of fuel is used for:
    a) Appliances - gas or electric?
    b) Hot water heater - gas or electric?
    c) Furnace - gas, electric, oil?

3. Notice which way most of the windows face; if they face north, the house may be colder in winter - if they face south or west, it will be hotter in summer.

PROJECT EFFECT

ENERGY FOR the FUTURE: EDUCATION, CONSERVATION, TRAINING

ENERGY SAVING TIPS

I. FREE
  A. Furnace:
    1) Keep ducts clear - don't block air flow.
    2) Let sun in to warm house during the day.

  B. Water Heater:
    1) thermostat - turn down from high to medium, for every 10° lower, you can realize a 10% savings.
    2) laundry - wash with cool water wherever possible.
    3) shower and baths: take showers instead of baths.
    4) drain water heater regularly (at least twice a year)

  C. Cooking:
    1) oven - whenever possible, cook more than one item at a time.
    2) cover pots when cooking on the stove.
    3) use low temperature on pots or pans after bringing to the boiling point.

  D. Lighting:
    1) use lower wattage bulbs.
    2) turn off lights that are not needed.
    3) use fluorescent bulbs, wherever possible.
    4) install rheostat switches (dimmer lights), wherever possible.

II. CHEAP
  A. Done before insulation
    1) caulking and weatherstripping
    2) plastic on windows on inside of house.

  B. Change furnace filters often.

III. EXPENSIVE
    1) insulation
    2) storm doors and windows
    3) insulated drapes
    4) opaque shades

RESOURCE C

ENERGY SAVING TIPS

HOME HEATING

1) Thermostat - set the thermostat to the lowest possible setting which is still comfortable for your family. 65°F is recommended for daytime, 55°F at night. When on vacation, 50°F. If necessary, wear warmer clothing. Every degree below 70°F during a heating season conserves about 3% in energy savings. Protect thermostat from drafts, fireplace and any heat producing equipment. Lower the thermostat when many people are present.

2) Humidity - a humidifier will maintain proper humidity of 25 to 35%, the air will feel warmer, furniture will not dry out and crack, and there will be less static electricity.

3) Furnace filters - should be checked once a month and cleaned or replaced.

4) Air leaks - caulk door and window frames, install storm doors and windows (doors and windows account for about 12% of the heat loss). Caulk all cracks around chimney, walls, and foundation. Infiltration (cracks, openings) accounts for about 11% of usual heat loss.

5) Insulation - install adequate ceiling (45% of usual heat loss) and exterior wall (12% of usual heat loss) and floor (about 20% of usual heat loss) insulation.

6) Fireplace - keep damper closed when not in use. Use of fireplaces on extremely cold days wastes heat. Use on days when there is slight chill in the house.

7) Drapes, shades or blinds - keep closed at night and on cold dark days. Keep opened on sunny days.

8) Maintenance - clean and adjust furnace each heating season for efficient operation.

9) Windows and doors - install storm windows and doors, thermal glass or heavy plastic sheets over doors and windows to reduce drafts.

10) Open and close outside doors quickly so that cold air won't gush in.

11) Never use the oven to heat your house.

12. Wrap insulation around heating ducts or pipes in unheated basements or crawl spaces.

13) Never block hot air outlets with furniture or drapes.

14) Shut off heat in unused rooms and keep doors closed.

15) Weatherstrip garage door and windows if garage is attached to house and unheated.

ENERGY SAVING TIPS

HOME COOLING

1) Install a power roof ventilator or provide adequate attic ventilation even if air conditioning isn't used.

2) Run an attic fan on cooler days and nights instead of air conditioner.

3) Close shades on sunny side of house.

4) Vent clothes dryer to outside, or hang clothes outside to dry. Clean vent regularly.

5) Prepare meals that don't have to be heated or cook in small self-heating appliances to keep kitchen cool.

6) Use kitchen and bathroom exhaust fans to reduce heat and humidity.

7) Turn off heat producing appliances (radios, televisions, etc.) and lights when not needed.

8) When shopping for an air conditioning unit or other major appliance, choose the most efficient one with a higher EER (energy efficiency ratio). An EER is the output in Btu's per hour divided by wattage input. Ex: 10,000 Btu air conditioner using 1,000 watts would equal $\frac{10,000}{1,000} = 10$
The EER = 10. The higher the EER, the more efficient the appliance.

9. Locate air conditioning unit on shady side of house away from shrubs and dryer vent.

10. Don't block air circulation with furniture or drapes.

11. Set thermostat for central air conditioning around 78°.

12. Keep the sun, light fixtures and heat producing appliances away from the thermostat.

13. Run the air conditioner only when necessary and not out of habit.

ENERGY SAVING TIPS

WHEN BUILDING, LANDSCAPING OR REDECORATING....

1) Choose a light colored roof to reflect the sun's heat.

2) Plant an effective windbreak north of the house, such as evergreen hedges or trees.

3) Plant leaf-bearing trees on the south, east and west sides to block out the summer sun and let the sun through for warmth in winter.

4) Install window awnings to block the summer sun.

5) Hang lined or foam-backed drapes for added insulation.

6) Paint ceiling and walls a light color to reflect light and heat. Use enamel paint, because it's nonporous, and more heat conserving than latex.

7) Consider wallpapering, paneling and carpeting rooms for added insulation.

MISCELLANEOUS ACTIVITIES - PRACTICUM

The following materials are used to meet the Miscellaneous Activities module objectives in Volume i (p. 93).

Objectives	Resource
1	Policies and Procedures for Practicum Resource A, C-H
1 & 2	Scheduling for Practicum Resource B.
3	Career development possibilities Resource H. One Day Seminar: "Realities of Small Business", Resource I.
Evaluation	Post-test (same as pre-test) and Developmental Aptitude Test (DAT).

POLICIES & PROCEDURES FOR PRACTICUM

(Supplement to earlier P&P's)

I. Conferences and Meetings with Staff supervisors:
The trainee and the staff supervisor shall meet regularly to discuss observations and other practicum experiences.

II. Seminars and Meetings:
Weekly meetings will be held each Friday to share experiences, summarize observations, refine the observation and audit procedures and plan for the following week. Part of this day may be used to focus on a specific topic using the seminar format - where students present group or individual reports and then discuss them.

III. Attendance and Punctuality:
Trainees are expected to be at the observation or audit site on time. Efforts will be made to arrange shared transportation but it is the responsibility of the trainee to firm up schedules, meet them, or make alternate plans.

Trainees must phone if they will be absent - if they know ahead of time they may phone staff the evening before the absence. If a trainee does not have a phone, now is the time to plan how to get to one in an emergency. The same goes for promptness. Call if you think you'll be late. Observation and audit teams will be leaving on time. If you call in you may be told where to meet them later.

IV. Evaluation:
Trainees will be evaluated on the basis of:

- Observation logs
- Host Evaluations
- Project Supervisor Evaluations
- Community Education Activities
- Audits
- Participation in Seminars, Meetings and Evaluation Sessions

For each individual activity the trainee will receive feedback on his or her performance. Total progress will be reviewed regularly and the final report will be a composite of all the practicum activity evaluations.

In the event that a trainee's performance drops below a satisfactory level for any component, there will be an immediate conference with Project staff to discuss the alternatives.

Because the practicum does involve constant public exposure for Project EFFECT, it is imperative that you act in a professional manner at all times. Every individual's conduct reflects upon the entire Project and anyone who does not abide by the Policies and Procedures, as defined above, will be immediately separated from the practicum experience and, depending upon the offense, could be terminated from the program. This decision would be made jointly with CETA officials and the Project staff.

Since our public image can determine whether or not there will be job offers after the practicum, no one can afford the luxury of immature or unprofessional conduct.

PRACTICUM: FIELD OBSERVATION SCHEDULE - MAY 25, 1978
(Tentative)

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
WEEK I June 5-9	5 Insulating Engnrs. TEAM B I & M Electric TEAM C	6 Insulating Engnrs. TEAM A I & M Electric TEAM B	7 COMMUNITY EDUCATION - ON CAMPUS	8 Insulating Engnrs TEAM C I & M Electric TEAM A	9 ON CAMPUS
WEEK II June 12-16	12 NIPSCO TEAM C (½ day)	13 NIPSCO TEAM B (½ day)	14 ON CAMPUS	15 NIPSCO TEAM A (½ day)	16 ON CAMPUS
WEEK III June 19-23	19 ACTION (½ day) TEAM C (½ day to choose from among...) a. S.B. Bldg. Insp. b. Realtors Assn. c. Citizens Action Coalition d. St. Joe County Health Dept. e. IUSB Engineering Office	20 ACTION (½ day) TEAM B	21 ON CAMPUS	22 ACTION (½ day) TEAM C	23 ON CAMPUS
WEEK		SAME AS MONDAY	ON CAMPUS	SAME AS MONDAY	ON CAMPUS

PROJECT EFFECT - PRACTICUM

June 1-2 Orientation: Teams, Objectives, Procedures and Requirements, Schedules

	Monday	Tuesday	Wednesday	Thursday	Friday
Week I June 5-9	A- sup. audit B C- observe	C- sup. audit A B- observe	Comm. Ed. ALL	B- sup. audit A C- observe	All trainees on campus: refining procedures, debriefing, share observations, counselling
Week II June 12-16	A- semi. sup. B audit C- observe	C- semi. sup. A audit B- observe	WORKSHOP PREPARATION - PEER GROUP TRIALS	B- semi. sup. C audit A- observe	Follow-up on Community Impact, guest lectures, placement counselling, critique & evaluation
Week III June 19-23	A- semi. sup. B audits C- observe	C- semi. sup. A audit B- observe		B- semi. sup. C audits A- observe	
Week IV June 26-30	House audits - semi supervised - pairs Community Education - In house workshop preparation and peer trials/Cont. Ed. workshops				
Week V July 3-7	Pairs and small groups - semi-supervised audits ½ time internships - Comm. Education and technical workshops for outside groups				
Week VI July 10-14	Independent audits - pairs Community Education and technical internships - according to interest and ability				
Week VII July 17-21	Special projects - independent Placement activities				
Week VIII July 24-28	All on campus - integration, counselling, placement		GRADUATION - JULY 28		

RESOURCE B

Resource B

THE ROLE OF THE PROJECT SUPERVISOR - I.U.S.B.

A. Liaison agent between I.U.S.B./Project EFFECT and host organization
   1. Interprets Project program to host/supervisors and their organization.

   2. Promotes good working relationships among all personnel involved in the program.

   3. Serves as "trouble-shooter" for I.U.S.B. to resolve problems relating to observation and practicum; monitors attendance, punctuality and behavior on the job.

   4. Visits trainees on site regularly.

B. Primary contact person for Project trainees and hosts.
   1. Assists trainees in understanding Project expectations and requirements.

   2. Assists hosts in supervising trainee observations and making them worthwhile learning experiences.

   3. Assist trainees in performing required tasks to expectations.

   4. Supplies hosts with specific statement of objectives, procedures and expectations and makes sure they are clear to the host.

C. Summarizes and puts observation component into proper context within the Project
   1. Meets regularly with trainees to answer questions and assess progress.

   2. Supervises sharing of observation and audit experiences among trainees.

   3. Helps trainees draw conclusions and summarize experiences in Project context.

   4. Evaluates trainee performance in observation and practicum experiences through direct observation, reading of "logs" kept by trainees, discussion with trainees and individual conferences.

THE HOST IS EXPECTED TO:

1) Give a brief explanation of how the observation period is structured; for example, the schedule for the day and what types of situations they are likely to see.

2) Answer trainee's questions, where possible.

3) Introduce trainee as a participant in an Energy Conservation training program when meeting the public.

4) Sign the trainee's log sheet, noting that hours are correct. Fill in responses to questions on the evaluation sheet, sign it and mail it back in the enclosed stamped envelope.

THE TRAINEE IS EXPECTED TO:

1) Be prompt or preferably early - remember that your host has a job to do and your presence may mean that he or she will need extra time.

2) Dress appropriately - wear your jumpsuit if going on service calls, otherwise normal business attire if you are assigned to a customer relations desk.

3) Remember your equipment - Log sheets, clip boards, necessary tools, pen or pencil; don't borrow from your host.

4) Use the telephone - for any and every reason!!! Call the Project office if you must be late, absent, your host doesn't show up, you're not sure where to go, etc., etc. This is crucial both to the functioning of the practicum and to our relations with the host organizations. However, never use the host's telephone for personal calls during working hours. Important messages will be relayed through the Project office.

5) REMEMBER TO FILL IN AND HAVE YOUR HOST SIGN AND COMPLETE YOUR LOG. YOU ARE RESPONSIBLE FOR THIS!!! If you observe with more than one host on the same day, use different sheets.

6) Give your host the Evaluation Sheet and attached envelope and ask that it be returned as soon as possible.

7) CARRY YOUR I.U.S.B. - PROJECT EFFECT I.D. CARD AT ALL TIMES.

PROPOSED JOB DESCRIPTION:

ENERGY EXTENSION AGENT, PROJECT EFFECT

At the conclusion of the training period, the EEA will be able to:

A. Conduct light building (including residential) heat need surveys

B. Conduct light building (including residential) cooling need surveys

C. Determine heating plant criteria

D. Determine cooling plant criteria

E. Specify insulation by:
   1. Type
   2. Need
   3. Material
   4. Heat transfer rating factor
   5. Fire factor

F. Identify and specify appropriate use of common building materials in relation to energy conservation in the resulting structure

G. Understand and recommend implementation of appropriate OSHA rules as applied to light industry

H. Utilize standard architectural drawings and blueprints in assessing the energy efficiency of existing and proposed structures

I. Calculate and understand heating and cooling degree-days

J. Use standard thermal measuring instruments, including:
   1. Radiometers
   2. Pyrometers

K. Use standard electrical measuring instruments, including:
   1. Amp Probe
   2. Volt Meter
   3. Amp Meters
   4. Insulation Tester

L. Understand the operation of common residential heating, cooling, and heating and cooling plants

M. Work with groups in community education for home energy conservation

N. Assisting home owners in becoming energy economists (i.e., what is a kilowatt?)

O. Conduct neighborhood energy conversation workshops

P. Understand methods of determining home appliance efficiency

Q. Consult with home owner concerned with home energy conservation

R. Disseminate government and other publications relevant to energy conservation

S. Recommend remedial action to overcome energy inefficiency

T. Act as liaison for the citizen vis-a-vis the public utilities

U. Sketch basic building plan layouts and guidelines

V. Identify unique neighborhoods -- their structuring and nucleating factors, etc.

ENERGY CONSERVATION OUTREACH OFFICER

DEFINITION OF WORK

This is skilled, technical, administrative work involved in educating, advising and providing technical assistance to residents experiencing difficulty maintaining appropriate energy consumption as well as required payment levels.

An employee works relatively independently, primarily in contact with residents, groups and community officials in providing technical information regarding "crisis intervention" monies; analyzes residential energy consumption; and assists in expending implementation of energy conserving methods and installation of materials.

EXAMPLES OF WORK PERFORMED

Investigates energy consumer complaints regarding utility bills in arrears.

Assists consumer in formulating repayment plan in conjunction with representative of utility company.

Explains governmental assistance which may include financial relief in the form of subsidies, loans, grants or other payments to reduce or eliminate utility debts.

Performs residential energy audit which identifies and specifies energy and cost savings which are likely to be realized through the purchase and installation of particular energy conservation measures or renewable-resource energy measures.

Explains and recommends appropriate weatherization techniques such as weatherstripping, caulking, insulation, storm windows and window repair and assists resident in making a request for such services.

Communicates daily energy conserving practices such as appropriate thermostat settings, use and maintenance of heating equipment and appliances, use of curtains and drapes and water and power utilization which offer cost and energy savings to the resident.

Calculates cost of installing or applying such energy conserving practices against monetary savings or benefits and specifies time periods for such savings.

Makes energy conservation presentations before residential, community, commercial and governmental groups in order to communicate and explain energy conserving measures as well as inform such groups regarding funds, materials and labor which may be available through governmental assistance.

DESIRABLE KNOWLEDGES, ABILITIES AND SKILLS

Thorough knowledge of local, state and national requirements of residential energy conserving programs including "crisis intervention" monies.

Knowledge of basic weatherization services.

Knowledge of energy loss and consumption.

Ability to perform residential energy audit.

CAREER DEVELOPMENT: PROJECT EFFECT

The graduates of the training program will be prepared to accept positions as heating-cooling cost estimators for light buildings (including residences). Employment opportunities may be sought in the building industry, with building material suppliers, heating and air conditioner suppliers, insulation suppliers, insulation contractors, and home improvement-remodeling firms.

The graduates will also be qualified to accept employment with public agencies which deal with housing (ACTION, CSA, Housing Allowance, Substandard Housing, etc.). The graduates would act as estimators, data collectors, inspectors and consultants. These individuals could also be employed by public utilities to act as customer representatives, estimators, inspectors, etc.

Because of the emphasis in the curriculum on community education, conducting small group discussions, etc., graduates can function in energy conservation education roles. In these roles, the graduates may be employed in neighborhood education programs sponsored by the several public agencies. Similar public education programs are carried out by public utilities and some private firms. Similarly, it is anticipated that the graduates of this program will serve these employers in public education roles.

Realities of Small Business

One Day Seminar

for

Energy for the Future: Education, Conservation, training

Project EFFECT

July 20,1978

8:45 - 9:00 a.m.	Introduction	
9:00 - 10:30 a.m.	1) What is involved in starting a business? Long term commitment Establishing a reputation Visibility and Marketing	E.A. Rich
10:30 - 12:00 p.m.	2) Legal aspects of small business administration ---Legal terms, Liability, Different types of organizations, e.g., partnership, corporation, individual proprietorship	Melvin Reed
12:00 p.m.	LUNCH	
1:00 - 2:00 p.m.	3) Making the business work -- a realistic picture What do we mean by hard work Reputation and appearances - Projecting an image Honesty and Legality Weathering the cash flow problem - What to do until you make a profit	E. Greenwood
2:00 - 3:00 p.m.	4) Record keeping and accounting Reporting requirements for tax purposes and other inquiries. Keeping records for effective management	B. Robinson
3:00 - 4:00 p.m.	5) Sources of Information and help Financial Aid Advising	Paul Reed Small Business Admin.
4:00 - 4:30 p.m.	Summary	L. Waltz

Place: I.U.S.B. - Administration Building, Room A001B

Sponsored by: Project EFFECT-Indiana University at South Bend
Funded by U.S. Office of Education, Title I

Realities of Small Business
Project EFFECT
July 20, 1978

FACULTY:

Paul Reed, Small Business Administration, Indianapolis Office

E. Greenwood, Entrepreneur, Business Manager investor, Shopping Center Owner, etc; serves as member of college board of Directors, among others.

Melvin Reed, M.P.A., J.D. Attorney with firm of Lark, Reed & Chamblee, P.C.

Elmer A. Rich, Vice President for Corporate Affairs, St. Joseph Bank & Trust Co.

Robert N. Robinson, MBA, CPA - Associate Professor of Accounting, Dept. of Business and Economics I.U.S.B.

Loren E. Waltz, D.B.A. - Professor of Business Administration and Dir. of Management Development Programs, Dept. of Business and Economics, I.U.S.B.

BIBLIOGRAPHY:

Broom, H.N. and Longenecker, J.G., Small Business Management, South-Western Publishing Co., Cincinnati, O. 1975

*Doyle, D.M., Efficient Accounting and Record-Keeping, David McKay Co., Inc. 1977

Gross, E.L.; Cancel, A.R.; Figueroa, O.; Small Business Works: How to Compete and Win in the Free Enterprise System, Management Bookshelf, 1978

Lane, Marc J., Legal Handbook for Small Business, Management Bookshelf, 1978

*Seder, J.W., Credit and Collections, David McKay Co., Inc. 1977

Publications of U.S. Small Business Administration
MA#170 - The ABC's of Borrowing

MA#225 - Management Checklist for a Family Business

SMA#147 - Sound Cash Management and Borrowing

* Available at South Bend Public Library

INDEX

Modules and resources for each module are listed alphabetically. Page numbers key resources to Volumes i and ii. Resources listed with letters, i.e. Resources A and B, indicate that copies of the resources are in Volume ii.

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ALGEBRA REVIEW	Vol. i	15-17
	Vol. ii	10-17

Resources

Class exercises, lecture materials and instructor generated handouts, Resources A and B.

Project Retrotech Handbook, Federal Energy Administration, Washington, D.C. 20461.

Evaluation

Quizzes, Resources C-G.

BASIC GRAPHICS	Vol. i	26-31
	Vol. ii	56-59

Resources

Architecture Drafting and Design, 2nd ed., Helper and Wallach, McGraw-Hill.

Blueprint machine.

Heat Loss Calculation form: Modine Manufacturing Co., 1500 DeKoven Ave., Racine, WI 53401, Heating and Air Conditioning Division.

Drafting Kits.

Drawings and blueprints of IUSB buildings.

Instructor generated exercise, Resource A.

Evaluation

Quizzes, observations and critique of students work, Resource B and C.

BASIC WRITING	Vol. i	18-20
	Vol. ii	18-30

Resources

Editing checklist from The Little English Handbook, Resource G.

The Little English Handbook, E. J. Corbett, J. Wiley & Sons, Inc. 1973, 1977.

Lovins' article in Foreign Affairs magazine, Resource F (detailed reference in Energy Overview module).

Planning Worksheet, from instructor - Resource A.

Reports checklist, from instructor - Resource C.

Survivor article - Resource E.

Writing Problems, from instructor - Resource D.

Writing Strategies, from instructor - Resource B.

Evaluation

Instructors' assessment of students' progress based on class assignments.

Page No.

BLUEPRINT READING

Vol. i 32-34

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Resources

Blueprints of IUSB buildings

Evaluation

Oral testing on blueprints and building components.

Symbol recognition examination.

BUILDING CODES AND ENGINEERING GUIDELINES

Vol. i 35-37

Vol. ii 61-63

Resources

American National Standard Safety requirements for industrial head protection, Z89.1-1969.

ASHRAE 90-75.

"Basic Requirements for Building Code", prepared by Joseph Weiler, chariman, for the Building Code Advisory Review Board, Department of Industry, Labor and Human Relations, State of Wisconsin, Madison, WI, January 12, 1968.

"Building Materials," *Handyman*, Bariner Press, New York, N.Y. pages 99-116.

Indiana Uniform Building Code (6 Volumes).

Introductory lecture by city building inspectors using various pertinent code books.

OSHA Handbook for Small Businesses, OSHA, 2209, 1977.

Evaluation

Exam - Resource A.

COMMUNITY EDUCATION

Vol. i 68-72

Vol. ii 157-170

Resources

Assertiveness Training and interview techniques practice with videotape.

"Community Education" topic outline, Resource A.

"Community Education - Workshop Preparation", student generated, Resource C.

"Mailing List and Procedures for Project EFFECT", student generated, Resource E.

"Mailing List Profile", student generated, Resource F.

"People Involvement, People Power, and Community Organization", handout, Resource B.

Rationale for Mailing List - Project EFFECT", student generated, Resource D.

"The Press Release", handout, Resource G.

Evaluation

Instructor evaluation of student

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COST CALCULATIONS	Vol. i	61-63
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Resource

ASHRAE Handbook - Systems Volume - Estimating Annual Fuel Consumption and Materials on Hot Water.

Billing and Audit Procedures, handout, Resource B.

Payback and Return on Investment, handout Resource A.

Rates for Gas Service, handout from local gas company.

Evaluation

Exam, Resource C.

ELECTRICITY	Vol. i	38-40
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Resource

Current electrical rates for locale, handout.

Electricity and Wiring, Handyman, Bariner Press, New York, NY, pp. 389-420.

Electrical equipment and measuring devices.

"Glossary of Electrical Terms", student generated, Resource A.

Understanding and Using Electricity, McKenzie and Zachariah, Interstate Printers, Danville, IL, Units 1, 2 and 7.

Uniform Electrical Code.

Wire dimensions handout, Resource B.

Evaluation

Instructor's exam, Resource H.

Instructor's quizzes, Resources C-G.

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ENERGY OVERVIEW	Vol. i	21-24
	Vol. ii	31-55

Resources

Direct Use of the Sun's Energy, Farrington Daniels, Ballantine Books, NY, 1964.

Energy and Society, T. J. Healy, Boyd and Fraser Publication Co., San Francisco, 1976, Chapters 2, 3, 8, 9, 15.

Energy Enviornment Simulator Activity, Resource C.

The Energy Path Fish-Bowl, activitiy, Resource B, based on the following Lovins' articles:

> "Energy Sources of the Future", J. P. Sanders.
>
> "Energy Sources for the Future", CONF. 760744, ORAU, Oak Ridge, TN 1976.
>
> "Energy Strategy: The Road Not Taken?", Amory B. Lovins, Foreign Affairs Quarterly, October 1976.

Lecture material and slide presentation, Resource A.

"Secure Storage of Radioactive Waste", EPRT Journal, Jul. - Aug. 1976, pp. 6-14.

The Solar Home Book, Bruce Anderson, Cheshire Books, Harrisville, NH.

Woodburners Encyclopedia, Jay Shelton, Vermont Cross-roads Press, Waitsfield, VT, 1976, Chapters 1-4, 6, 7, and 9.

Evaluation

Final Exam, Resource E

Solar Test, Resource D

ENERGY USE SURVEY	Vol. i	64-66
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Resources

ASHRAE Handbook of Fundamentals, 1972.

Project Retrotech Handbook, Federal Energy Administration, Washington, D.C. 20461.

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ENERGY USE SURVEY - PRACTICUM

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Resources

See Energy Use Survey Module.

Evaluation

Critique of audit components.

Staff evaluation of individual's ability to conduct independent energy use surveys.

FIELD OBSERVATIONS - PRACTICUM

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Resources

Field representative for Citizens Action Coalition, a local citizen's group involved with utility rates.

List of objectives, Resource A.

Trainee discussion and observations of field experiences.

Evaluation

Daily log and evaluation by trainee, Resource B.

Host evaluation of trainee, Resource D.

Staff evaluation of trainee, Resource C.

Trainee discussion and participation.

INSTRUMENTATION

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Resources

Physics laboratory equipment and measuring devices.

Understanding and Using Electricity, see reference in Electricity module.

Evaluation

Exam, Resource A.

INSULATION MATERIALS AND TECHNIQUES

Vol. i 51-53

Vol. ii 100-103

Resources

ASHRAE Handbook of Fundamentals, chapter 20, 1972.

Infra-red scanner introduced by insulation contractor.

"Insulation Manual", National Association of Home Builders, Inc.

"Insulation Values of Materials", Anderson, B., The Solar Home Book, pages 274-279.

Samples of different insulating materials provided by insulation contractor, "Study of Various Insulation Materials", Home Weatherizing Manual pages 10-35, TVA Energy Conservation Materials.

Evaluation

Exam, Resource A.

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INTRODUCTION TO COOLING SYSTEMS

Resources

ASHRAE Guide and Data Book, 1963, Chapter 26, pp. 500-501 - Resources B & C.

ASHRAE Handbook of Fundamentals, 1972, Chapter, 1.

Climatological data from weather bureau.

Definitions of COP and EER - Resource E.

Performance chart on Freon-12 - Resource A.

12-step estimating procedure for calculating Design Cooling Loads - Resource D.

Understanding and Using Electricity, see reference in Electricity module, pp. 76-80.

Evaluation

Instructors exam, Resource F.

INTRODUCTION TO HEATING SYSTEMS	Vol. i	45-47
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INTRODUCTION TO HEATING SYSTEMS

Resources

ASHRAE Guide and Data Book, 1960, Chapters 33 and 36.

The Components of Comfort: Do You Remember Them? Resource C.

Definitions of Degree Day, Design Temperature Difference, C, K, U, and R values, handout, Resource A.

Heating System checklist, Resource D.

Manual of Home Weatherizing, TVA Energy Conservation Material.

Retrotech Manual sections on heat loss.

R-values of some common building materials, handout, Resource B.

Evaluation

Exam, Resource E.

LIGHTING EFFICIENCY

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Resources

Electricity and Wiring, see reference in Electricity module.

Foot candle meters.

Sample problems, Resource A.

Evaluation

Exam, Resource B.

MISCELLANEOUS ACTIVITIES - PRACTICUM

Vol. i	92-94
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Resources

Career development possibilities, Resources F-H.

Policies and Procedures for Practicum, Resources A, B-E.

"Realities of Small Business", Seminar, Resource I

Scheduling for Practicum, Resource B.

Evaluation

Developmental Aptitude Test (DAT).

Energy post-test (same as pre-test).

NEIGHBORHOOD AND COMMUNITY ORGANIZATIONS

Vol. i	73-75
Vol. ii	177-189

Resources

Proposed Developments for Target Area, handout, Resource G.

Southeast Neighborhood Target Area, handout, Resources A-E.

What to Look for in Groups, handout, Resource F.

Evaluation

Exam, Resource H.

NEIGHBORHOOD WORKSHOPS

Vol i	86-88
Vol. ii	197-203

Resources

Instructor from Community Education Module "Neighborhood Workshops" handout, Resource A.

Student generated materials, Resources B and C.

Weatherization Director, ACTION, Inc., lectures

Evaluation

Staff evaluation of workshop presentation.

Student evaluations of each other's presentations.

THE ORGANIZATION OF STATE AND LOCAL GOVERNMENT

	Page No.
Vol. i	76-78
Vol. ii	171-172

Resources

Attend City Council and Board of Public Works meetings.

Civic Cinema, South Bend Civic Planning Association, 29th Edition, 1977.

Here Is Your Indiana Government, Indiana State Chamber of Commerce, 18th Edition, 1977.

Presentation by Indiana State Senator.

Evaluation

Exam, Resource A.

ORIENTATION

Vol. i	12-14
Vol. ii	4-9

Resources

Calendar of Month One activities, plus resources A-D.

CETA Regulations.

Group Dynamics Consultant

Project Staff.

IUSB information: calendar of events; fact sheet brochure; maps of campus and library; bus schedule.

Evaluation

Critique and evaluation forms filled out by students at the end of orientation week.

REGIONAL DEMOGRAPHY

Vol. i	79-81
Vol. ii	173-176

Resources

"Factfinder for the Nation" on: "Housing Statistics", "Minority Statistics", "Construction Statistics", "Geographic Tools", and "Population Statistics", U.S. Department of Commerce Bureau of the Census.

Maps of Census Tracts for South Bend, Indiana.

Maps of existing land use for Community Development Program in South Bend, Indiana.

The 1970 Census and You, U.S. Department of Commerce, Bureau of the Census.

Evaluation

Quizzes, Resources A-C.

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REGIONAL WEATHER	Vol. i	57-59
	Vol. ii	111-126

Resources

Analemma, handout exercise, Resource C.

Climatological data from local weather bureau.

Cooling Power of Wind (Chill Factor), Resource D.

Earth-Sun Relationships, handout exercise, Resource B.

Intensity of Insolation at the Earth's Surface, handout exercise, Resource A.

Map of the world with sun angles, Resource G.

Psychrometric chart and tables, Resources E and F.

Weather instruments.

Weather maps.

Evaluation

Exam, Resource H.